The Welding Engineer

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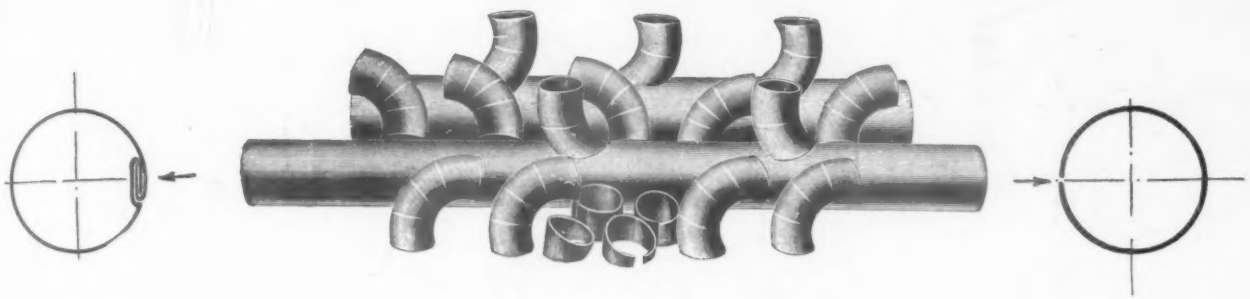

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Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Commercial Acetylene Welding Co.
Universal Oxygen Co.
Prest-O-Lite Co.

ACETYLENE (Dissolved)
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Superior Oxy-Acetylene Machine Co.

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Smith's Inventions, Inc.
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Universal Oxygen Co.

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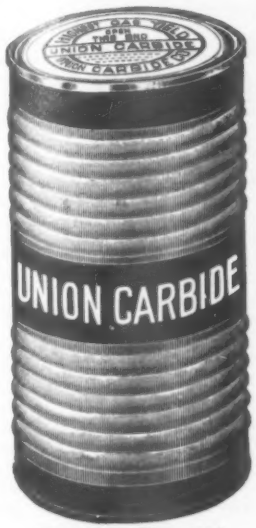

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Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
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Muskegon—303 W. Western Ave.
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Fargo—Fifth St. & Second Ave., North.
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Cincinnati—67 Plum St.
Cleveland—601 The Citizens' Building.
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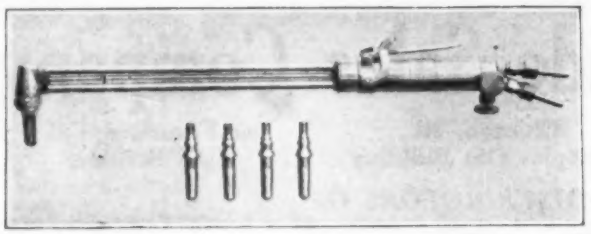

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Save the time spent cleaning yesterday's fires by using a HAUCK PREHEATING FURNACE

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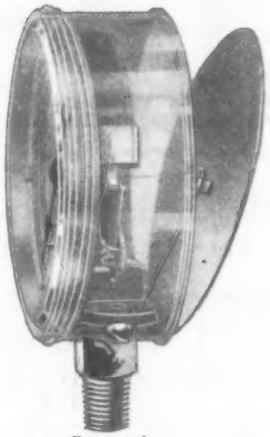

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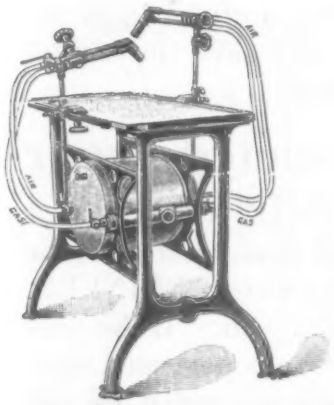

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"Weld-a-cast" adheres readily to the hot welding rod which picks up just enough and none is wasted; it does not blow away but melts at once; it eliminates blow holes and leaves the metal soft.

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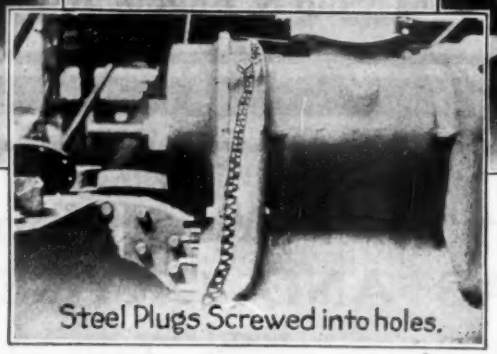
Westinghouse

Arc Welding Equipments

Holes drilled in staggered location.



Steel Plugs Screwed into holes.

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The illustration shows a cracked cylinder directly over the passageway between the valve chamber and the cylinder, which was repaired and restored to service by the use of Westinghouse electric arc welding equipment at a tremendous saving of time and money.

A row of holes was drilled on each side of the fracture, in staggered location, steel plugs were screwed into these holes, forming a V, projecting about one-half inch from the surface. Then the plugs were welded together by the use of the electric arc.

This was not an experiment, but a job that had been performed before and had stood the test of service.

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ROEBLING WELDING WIRE

(At Left)—Cast Iron Bed Plate from Browning Hoist, 15 tons capacity. Broken in several places. After 24 hours of welding, depositing 76 lbs. of Roebling 5/32 in. diam. Electrodes. Total cost of repairs, $35.80. A new casting would have cost $1,300.

(At Right)—Cast Iron Ladle. 7 tons. Crack, 16 ft. ½ in. wide, metal 3 in. to 4 in. thick. Repaired in 36 hours with 400 lbs. of Roebling Gas Welding Wire.

ROEBLING ELECTRODES

ROEBLING GAS WELDING WIRE

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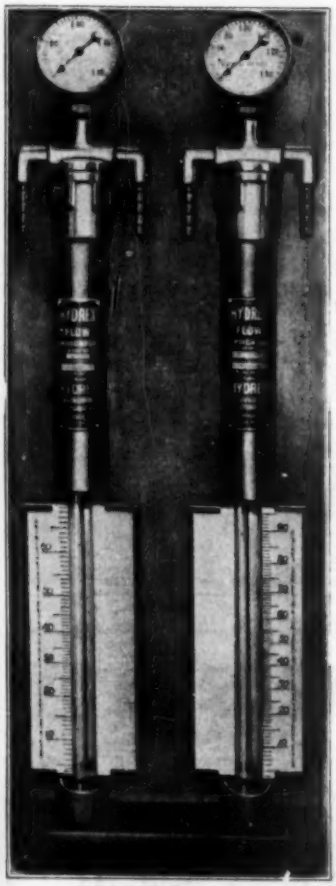
Trenton, New Jersey

WHO WAS RIGHT? WHO WAS WRONG?

Five Welders on Identical Work Same Torches—Same Tip Five Results



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Five old time welders were rotated on the same job, each making two welds in steel tank plate, ¼" thick, 3" wide, 10" long, normal tensile strength 45,000 lbs. per square inch—with the following widely varying results:

	Minimum	Maximum
Variation in acetylene pressure	2 lbs.	6 lbs.
Variation in acetylene flow	16 ft.	32 ft.
Variation in oxygen pressure	6 lbs.	35 lbs.
Variation in oxygen flow	27 ft.	58 ft.
Variation in gas mixture	1.24 to 1	1.65 to 1
Variation in strength of welds	Nominal*	31,200 lbs.

*Broken by hand.

Then the pressures and gas mixtures were set exactly according to the torch manufacturer's instructions and five welds were made by one man, using the same torch and tips, with these results:

Acetylene pressure 2 lbs. Acetylene flow 16 ft. per hr.
Oxygen pressure 6 lbs. Oxygen flow 17.5 ft. per hr.
Gas mixture 1.15 parts oxygen to 1 acetylene.
Tensile strength of five welds from 36,000 to 39,000 lbs.

What The Hydrex Does

Shows quantity of each gas, and mixture being used at any instant in any torch.

Can be used with any combination of gases.

Shows whether tips have been reamed or burned, and are using excessive amounts of gas.

Shows whether one welder uses twice as much gas for the same job as another welder.

Enables you to standardize all welding, rather than allow every man to weld in his own way. Enables you to check gas cost on all estimated work, and determine gas cost on all job work.

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Doesn't that speak for itself? Doesn't it prove that most operators use random pressures, random mixtures, and get random results in welds? But it isn't the welder's fault. He gets a neutral flame, as nearly as his eye can judge it, yet indicators have shown some of the best of them to get 35% away from a true mixture.

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A card will bring complete information, or an instrument for ten days' free trial, or one of our engineers who will study your conditions and demonstrate what the Hydrex will do for you—all without obligation on your part.

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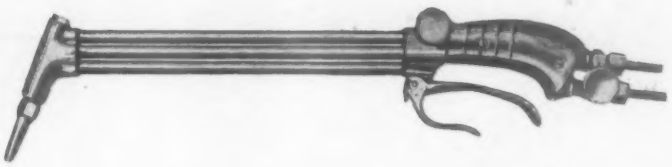
No. 9



You use four fingers on the cutting jet lever when you grip this torch to hold it to its work. This means smooth, easy control that will not throw the head out of line.

For cutting special shapes, sheets, steel work, cutting risers on heavy steel castings, or for scrap cutting this torch is superior to any other torch yet made. Conveniently located cutting jet lever, comfortable grip and perfect balance make it easy to work with.

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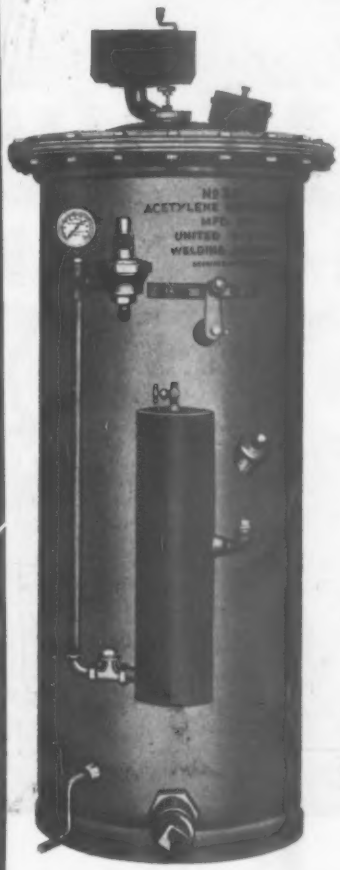

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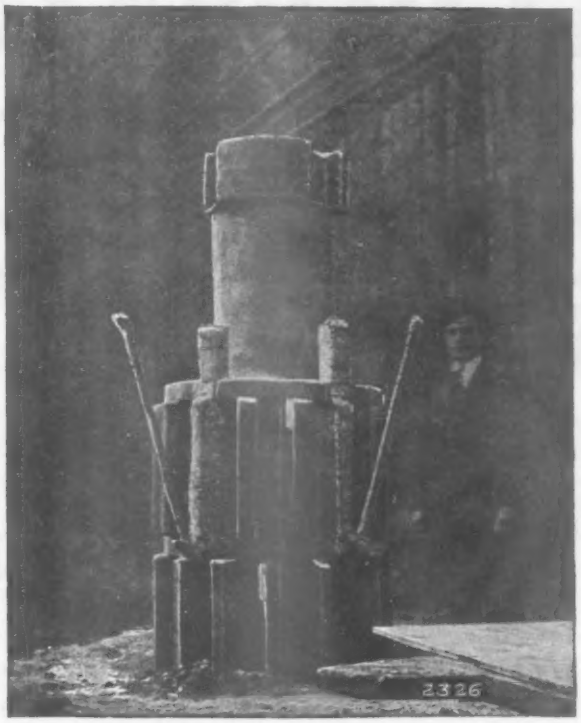

New Thermit steel teeth welded into pinion, two of 40 other perfect Thermit welds made by the same company.

One of many cases where abundant use of

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A large steel plant in Monessen, Pa., during the four months previous to the latest report received from it, had used approximately 16,000 lbs. of Thermit on about 40 welds on pinion and roll neck pods, pinion teeth (the illustration shows two of these pinion tooth welds), charging peels and other work, ranging from 200 to 1500 lbs. of Thermit used per weld *without having wasted a pound because no failures had occurred!*

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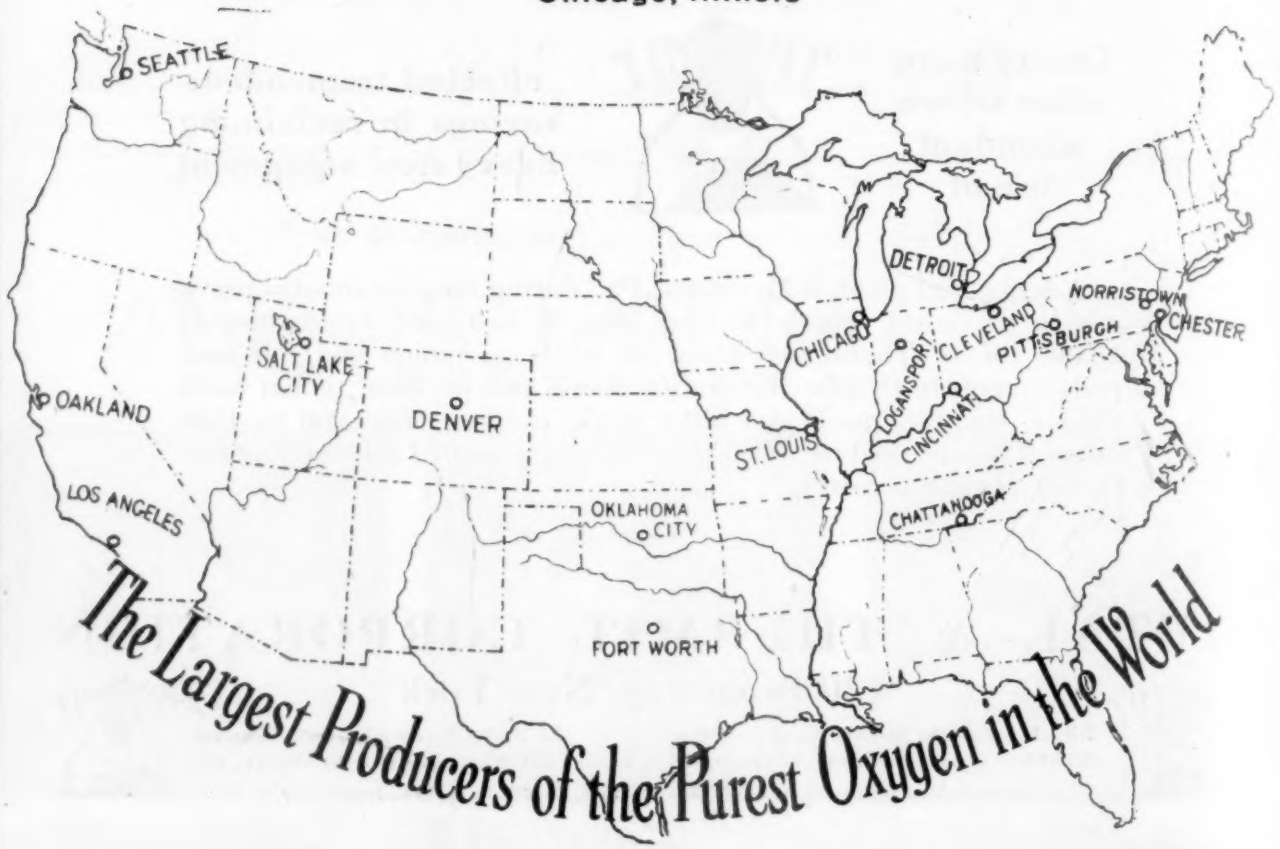

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WELDERS MOULDING COMPOUND

Practically every country in the world is now using this wonderful fire resisting compound. It does not blister, or work into the weld; takes the place of carbon blocks and rods; saves holes and machined surfaces; makes casting of missing lugs and other parts very simple; and as a cushion for pre-heating work and in aligning work, shims are forgotten and 50 per cent of the welder's time is saved by using this compound.

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Manufactured Exclusively by

UNITED STATES WELDING COMPANY, INC.

Minneapolis, Minnesota, U. S. A.

composed again into barium oxide and free oxygen. This economic process has been worked on a large scale in various places. But since the early years of the twentieth century oxygen has been chiefly manufactured by the Linde process, which consists in liquefying air and subjecting it to fractional distillation by means of a suitable rectification column (see DISTILLATION), which readily yields an oxygen that is 98 or 99 per cent pure. To a much less extent, at present, oxygen is manufactured by the electrolysis of water.

Oxygen (symbol, O; atomic weight, 16; see ATOMIC WEIGHTS) is a colorless, odorless, and tasteless gas which has been condensed to a pale steel-blue, transparent liquid, boiling at −181.4° C. and freezing to a white solid at −235° C. Compared with air as unity, oxygen has a specific gravity of 1.1504, and it is the least refractive of all gases. Oxygen is slightly magnetic, which property is diminished or temporarily suspended by elevation of temperature. When examined through thick layers oxygen has a bluish tinge of color. It combines directly with most of the elements. (See OXIDES.) It is sparingly soluble in water, and nearly all natural waters contain oxygen in solution, which can be completely removed by boiling in vacuo. This dissolved oxygen is necessary to sustain the life of fish. In the pure state oxygen may be inhaled, for a time, with impunity, and it even acts as a tonic or exhilarant. Its long-continued respiration, however, is harmful. In pure oxygen bodies burn with much greater brilliancy than in common air. See COMBUSTION.

Oxygen has been used successfully to maintain air in a respirable condition, as in diving bells, submarine vessels, etc., and its use has been suggested for the revivifying of the atmosphere in public halls. It finds extensive application, in connection with hydrogen or illuminating gas, in the production of the oxy-hydrogen flame. (See DRUMMOND LIGHT; OXY-HYDROGEN BLOWPIPE.) It is also used in the bleaching of paper pulp, in the oxidation or thickening of oils which are used in the manufacture of varnish and oilcloths, for the purpose of hastening the maturing of spirituous liquors, and in the manufacture of [illegible]. But by far the most extensive use at the present time is, in connection with the oxyacetylene flame, for welding [illegible] metals. Consult: Jörgensen, *Die Darstellung des Sauerstoffes* (Stuttgart, [illegible]); Verneuil, *Dictionnaire de Chimie, Composition of the Atmosphere, Special Reference to its Oxygen* (published by the Carnegie Institution, 1912); Georges [illegible], *Oxygen and Nitrogen* (Philadelphia, [illegible]).

OXYGEN. [illegible] used, both [illegible] three ways: [illegible] by driving [illegible]

pneumonia, when there is danger to life from deficient aëration of the blood, in the chronic bronchitis of old people, and for the resuscitation of victims of coal-gas asphyxiation, oxygen gas is of very great value. It will allay the oppression and dyspnœa in phthisis and other wasting diseases. It acts as a direct stimulant to the respiratory mucous membrane and has a beneficial effect on the heart and respiration. When prolonged anæsthesia is necessary, oxygen is often given in conjunction with the general anæsthetics, to relieve cyanosis and as a safeguard against cardiac or respiratory failure. [illegible] ture of nitrous-oxide gas and oxygen [illegible] one of the safest general anæsthetics. The use of oxygen in [illegible] valuable opinions and [illegible] A. H. Smith, of [illegible]

OXYGENATED [illegible] DIOXIDE.

OXYHYDROGEN [illegible] POUND BLOWPIPE. [illegible] which hydrogen [illegible] flame has [illegible] This apparatus [illegible] of Phillips [illegible] hydrogen [illegible] high [illegible] But [illegible] is [illegible]

An Authority Speaks!

"But since the early years of the twentieth century oxygen has been chiefly manufactured by the Linde Process. . . . . "

The newest edition of the NEW INTERNATIONAL, which as you know is an authoritative encyclopedic work, says the above upon the subject of oxygen. It is a well known truth that oxygen manufactured by the Linde process is in a class by itself.

THE LINDE AIR PRODUCTS CO.
30 East 42nd Street, New York
Kohl Building, San Francisco

The Largest Producer of Oxygen in the World

L-508

THE AMERICAN FUND FOR THE CHILDREN AND ORPHANS OF FRENCH WELDERS

On November 1, 1918, our association was officially advised that a group in the welding industry in the United States, headed by Messrs. Nyquist, Hume and Mackenzie were soliciting subscriptions for the children of French welders who were victims of the war.

A little time after the Compressed Gas Manufacturers' Association joined to the subscription.

In February, 1919, we received the two subscriptions amounting to 10,614.55 francs of which 6,380.80 was from the welding group and 4,223.75 was from the Compressed Gas Manufacturers' Association.

Our association at that time was in a stage of transformation and it was not possible to distribute the gift, but a committee was formed to study the question of disposal of this generous offering.

In May, 1919, a circular letter was addressed by the committee to all members of the association requesting that all members should nominate employes who appeared to merit the sharing in the offering received from America.

The conditions proposed by the committee were: "The contribution will be, after investigation, distributed to the children of welders or employes of gas manufacturing plants. It will naturally be given to the children of welders killed by the enemy, wounded in action or victims of accidents and diseases which have placed their families in an impoverished condition."

Since the end of October we have had in our possession seventeen cases to inquire into and made investigation. The committee in its meeting of October 28th appointed its president, M. Butin, and its secretary, M. Pierre Rosemberg, to handle the question, determine the allotments and to make a report of action to the committee.

The inquiry being finished we propose to the committee the following distribution of funds:

1 A sum of 1,000 francs to each of the following families, Ponce, Pelle and Smyrne.

2 The sum of 800 francs to the following families, Gras and Leroux.

3 The sum of 600 francs to the following families, Marcelot and Pechard.

4 The sum of 500 francs to the following families, Pire, Demarchelier, Guitel, Yvenat, Souchet, Baudry, Hunnibal and Bernhardt.

5 The sum of 400 francs to the following families, Pillard and Namur.

Below is given some of the details in each case that prompted the distribution:

Pelle, Albert Pelle was a welder with the Soudure Autogene located at St. Nazaire. Was mobilized from the beginning of the war with the 276th Infantry. He was killed by the enemy on December 21, 1914. His widow was left with two daughters, eight and twelve years old, respectively. The widow secured work in a dock yard and had no other means of livelihood than what she earned. From all points of view the award of 1,000 francs is warranted.

Ponce, Gilbert Ponce, welder since 1910 at the works of Ladreyt, near Paris. Mobilized at the beginning of the war. He was seriously wounded in October, 1914, was discharged from the hospital in October, 1915, permanently disabled. He was granted a pension of only 300 francs. He was given employment by his old employer, but could only perform the lightest work. He is the father of three small children.

Smyrne, Eugene Smyrne, was born in 1874 and was mobilized during the the beginning of the war. He was employed at the powder manufacture plant at St. Chamas as a welder. After he was sent to a firm in Marseillaise. He was accidentaly killed in September, 1919, leaving a widow and two small children. His widow secured work, but as her health was poor, could earn but little towards the support of the family. An aged invalid parent was also dependent upon her slender earnings. Madame Smyrne merits from every standpoint the award of 1,000 francs made to her.

Gras. Became a welder for the Soudure Autogene Francaise in 1910. He was wounded in action, discharged from the hospital and again entered service, dying shortly thereafter from the flu. He left a widow and two children, four and one-half and ten years of age. Madame Gras is earning a scanty living as a seamstress. The case has justified the award of 800 francs.

Leroux. Military class of 1903, was a welder with the Soudure Autogene Francaise. He was mobilized at the beginning of the war with the 265th Infantry. Stricken with typhoid he was committed to the hospital at Villere-Cotteret, dying on December 11, 1914. He left a widow and two children, six and eight years of age. Deprived of all resources Madame Leroux secured a position as a sales woman in a military canteen in order to educate her fatherless children. She is of a serious disposition and merits the award of 800 francs given to her.

Marcelot, Leon Marcelot, welder, was killed by the enemy in March, 1915. He left a widow and two children of eight and ten years. The award of 600 francs was sent to his brother who is the guardian of the children.

Piere, Lucien Pire, born in 1892, was a welder in Marsellaise. He was mobilized and sent to a workshop in Paris. He died in May, 1918, leaving a widow and a child of three years. She lives with her parents who are to a certain extent dependent on her. She works in a fish market from four in the morning until noon. The award of 500 francs is well merited.

Pechard. A welder before the war, he was killed by the enemy on January 13, 1915, leaving a widow and two boys, eight and twelve years of age. Madame Pechard, because of the fact that her parents are invalids is unable to work and has been granted an award of 600 francs.

Demarchelier, Georges Demarchelier was a welder in a workshop in Marseillaise before the war. He was killed at the Battle of the Marne, September 6, 1914. A widow and two children survive him. His widow works as a domestic in the morning and as a seamstress in the afternoon. The children are going to school. An award of 500 francs has been made in this case.

Guitel, M. Guitel, foreman of the Soudure Autogen Francaise, was killed by the enemy and M. Guitel has taken charge of the three children left by his son. An award of 500 francs is made.

Yvent, Gabriel Yvent, sheet metal welder, at the works of Butin, Paris, was mobilized at the beginning of the war with

*Supplement of the December issue of the Revue de la Soudure Autogene.

the 46th Infantry. He was wounded in September, 1914, and died from the effects in August, 1916, leaving an adopted son, seven years old. The son, Joseph Erra, has been adopted by M. Raimbaud, of Butin's. An award of 500 francs is made and is merited.

Souchet, Gaston Souchet, foreman welder at the works of Butin, was mobilized at the beginning of the war as an engineer miner with the 72nd Infantry. He was wounded in September, 1914, and was killed by an enemy shell that fell on the hospital he was in in Paris recovering from his wounds. He left a son, Andre Joetzer, 13 years old, who is being taken care of by his mother. Five hundred francs is awarded.

Baudry, Henry Baudry, welder before the war, at the works of Schneider, at Chalon-sur-Saone. Met his death on the field of battle and left a widow with a child of fourteen. The mayor of the city of Chalon has advised that an award in this case is well justified and 500 francs is given.

Hunnibal, Albert Hunnibal, born in 1892, was a welder at the shops of M. Girel before the war. He was mobilized at the beginning of the war, but was recalled during 1915 to act as an instructor in lead burning in connection with the construction of powder plants. During his work at the arsenal at Toulouse he became ill, was forced to undergo an operation and died from the effects of it in May, 1917. He left a widow and a child of four years. Five hundred francs is given.

Bernhardt, M. J. Bernhardt, born in 1885, at Mulhouse, was engaged as a boilder welder in Luneville. After a certain time passed at the front he was recalled in view of his skill to act as foreman in a shop in Paris, making munitions. He died at the Edith Cavell Hospital in Paris in September, 1918. A widow and three children survive him. The family's situation is critical and an award of 500 francs is made.

Pillard, Francois Pillard, born in 1881, was a welder with a Paris company before the war. Mobilized at the beginning of hostilities. He met his death at the hands of the enemy October 27, 1915, at Henu. A widow and a child of six and one-half years survive him. His widow is working to support herself and the child and is living with his parents. She has never demanded assistance and the case is believed to warrant an award of 400 francs.

Namur, a welder at Ponte-Sainte-Maxene, was killed in October, 1918, leaving an adopted son, Auguste Lhermite, aged two years. The child is taken care of by a nursing home and is supported by his mother. Four hundred francs is awarded and merited.

The total of these contributions is 10,600 francs, nearly the total of the subscription.

In closing our work we again want to extend to our associates, the Americans, our many thanks for their kind action. We ask their indulgence for the delay that there has been in the distribution of their most generous gift. The gift will remain as an souvenir of the splendid feeling that exists between the welders of France and America.

We have proposed to the French Welding Society to take steps to send to each of the American subscribers a resolution showing the creation of the fund and its distribution.

We ask the society to give, by a unanimous vote, all thanks to the initiators of the subscription and to the associations that have made it a success.

A. Butin, Le President,
P. Rosemberg, Le Secretaire.

THE FRENCH OUTLOOK FOR 1920.

It cannot be said that the year 1920 has started under favorable auspices; whatever may be the present troubled state of commerce and industry, due to the transportation crisis, to the steady decrease of our exchange, to the high cost of living and to the numerous difficulties which are the cause of it, it is nevertheless interesting to foresee what might be our business during the new year.

The ills from which we suffer are doubtless not incurable, but their healing will be slow. That is perhaps what we have not the courage to tell to France, this poor patient, and it will take much effort and perseverance for her to rise completely from them.

The transportation crisis has probably not yet reached its acute period; our exchange is not yet coming back to what it should be; the cost of living will undoubtedly rise again; the taxes will at least be doubled and the many difficulties of which we complain will persist in assailing us . . . However, the earth will continue to revolve and while trying to better our future by a severe understanding of the motto: "To produce and to restrain ourselves" we will be obliged to do business anyway.

What will this business be? Partly what circumstances will decide they should be, but at the most what we will deserve. In spite of circumstances, man is always more or less the artisan of his success or of his misfortunes and he would often be justified in accusing himself instead of complaining.

The actual crisis injure certainly more the acteylene industry than many more less interesting and we cannot surely transform our factories and stores in dancing halls or cinemas. Raw material is high and does not reach us; no material, no accessories, no hand labor; everything is against an active man who wishes to undertake something; still there is a possibility of making good. Let us lose some of this habit of complaining against our fate. The difficulties that we are deploring of, every one suffers from them; we must march along with them and endure them. Let us be optimistic, nevertheless, and work with the circumstances as deplorable as they may be.

Truly, business is not lacking; we can even say that it has never been so easy to transact it for who ever wishes to take the trouble of going after it. Unfortunately, difficulties begin to appear when it is time to realize profit on deals which have been closed, that is to say, to produce, to deliver and to ship.

The obstacles that one meets are sometimes insurmountable, or at least they appear to be so; but, however, by showing the necessary activity, by using zeal and perseverance, by marching along with the events, in fact, one will always obtain results.

It takes hard work, indeed, as we say, to find the proper tradesman, the active intermediary, the opportune shipper, to insist without being too much in a hurry, conciliatory with all, a diplomat often and amiable always.

It is during these periods of difficult transactions that the master qualities of the industrial and business man show their full value, and those who have them obtain satisfactory results. Let us look around us and we will understand; let us imitate those who are successful.

The year 1920 will be a difficult one. It may perhaps have in stock for us new difficulties which we do not expect. Let us arm ourselves with patience and courage, and while working to better a situation which is deplored by all, let us take care of our business without throwing ourselves into fits of discouragement or neglect denoting cowardice. If everybody would obstinately resist the difficulties which are assailing us, each one's business would be much beter and that of France also.

R. Granjon, in Journal de l'Acetylene.

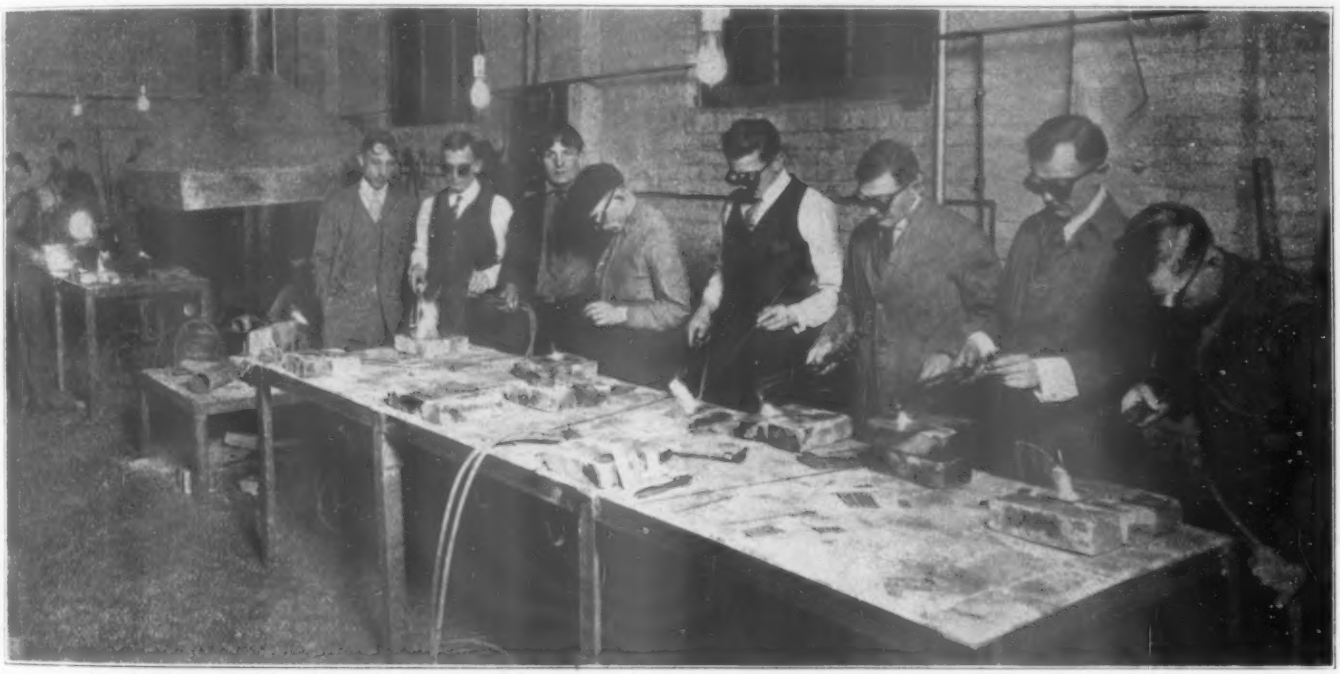
A Philadelphia Chapter of the American Welding Society has been organized. It is expected that at least one thousand members will be enrolled within a short time.

DENVER Y. M. C. A. WELDING SCHOOL

One evidence of the growth of the welding industry in the Rocky Mountain region is the experience of the School of Oxy-Acetylene Welding, recently organized by the Denver Y. M. C. A. in connection with their Automotive School.

Early in September, Earl J. Thompson, who had been with the Sun Shipbuilding Co., of Chester, Pa., was secured to teach a small class in welding as a part of the preparation needed by the students in the Automobile School. Three Prest-o-Lite stations and one cutting station were installed. Inside of six weeks it became necessary to add seven more welding stations, making it possible for the school to accommodate ten students in its day classes and ten at night. The demand became so great that these classes were filled up in no time and waiting lists were established. By January 1st the school had made such remarkable progress and so many applicants were waiting to enter that six more torches were added to the equipment and a 100-pound Oxweld high-pressure generator with a four-tank oxygen manifold were purchased. Even with these additions to the equipment, all the classes are filled to overflowing and a waiting list is still necessary.

Five different types of torches have been installed in order to give the students instruction on a number of the principal makes. In addition to the Prest-o-Lite, the Davis-Bournonville, the Purox, the Oxweld and the Henderson-Willis are now in use.



Denver Y. M. C. A. Welding School.

Students are taught to weld steel, cast iron, brass, copper and aluminum. They are also given instruction in the brazing and welding of various metals to each other, such as steel to cast iron, brass to steel, copper to steel, brass to copper, etc. One example of the work done by the students shows the nature of the work done: A short time ago the students knocked the side out of the water jacket of an automobile cylinder block, fitted a steel plate in the side, preheated and welded the steel patch into the block.

Automobile cylinders, aluminum crank cases, gear cases, steel gear wheels, cast iron wheels and other various castings including pipes of all sizes are secured at the local junk yards for use in the class work. Such castings as need it are pre-heated by means of an oil burner torch or charcoal fire. An immense amount of metal is required to give the students the instruction needed. Many of the junk men and metal dealers in the city have co-operated by allowing the school to use the metal and then return it without cost. In other cases a small premium is paid per pound for metal which has been worked over by the students.

The graduates of the school have gone in large numbers to the oil fields of Wyoming, Oklahoma and Texas and have secured positions paying a dollar an hour. The management of the school has been much gratified by letters from these men indicating that they are making good. Students are received into the school from many states around Colorado. The school is now the largest Y. M. C. A. welding school in the country and bids fair to become one of the leading trade schools of its kind in the United States.

THE ACETYLENE FLAME

Editor:

There has been little said recently concerning the nature of the oxy-acetylene flame. The kind of flame used, it seems to me, is of vital importance, regardless of the metal being welded. I have made an extensive study of the flame from the practical and technical standpoint and have read many books on the subject. These, as a rule, strongly recommend the use of the reducing or carbonizing flame in the welding of aluminum. This has been my practice until recently.

A short time ago I conducted a series of six experiments in the welding of aluminum which resulted as follows:

Small pieces of metal about 4 by 8 inches were welded together using a reducing flame with secondary cones of various sizes. In the first experiment I used a 4-inch cone; in the second a 3-inch cone; in the third a 2-inch; in the four a 1-inch and in the fifth a ½-inch cone. In the sixth experiment I used a neutral flame.

Each plate was placed in the vise and broken in the weld. The welds displayed the following results: In experiment No. 1 the plate broke very easily, displaying large gas holes in the center of the weld and had much the appearance of a sponge. I might say at this time that throughout the entire experiment the secondary cone was not allowed to come into contact with the molten metal. In the second experiment the plate broke easily, but not as much so as in the first case. There were also small gas bubbles, but they were smaller

than in the first experiment. The third plate had more strength than the preceding ones, but it also contained small gas bubbles. The fourth plate had a fair degree of strength, but the bubbles still appeared. The fifth plate was comparatively strong, but the weld showed many fine gas bubbles. In the sixth experiment the plate, which was welded with a neutral flame, was very strong, breaking only in part of the weld, but that portion of the weld which did break gave evidence of being a solid, well-packed weld free of gas bubbles or blow holes. Flux was used in this experiment throughout.

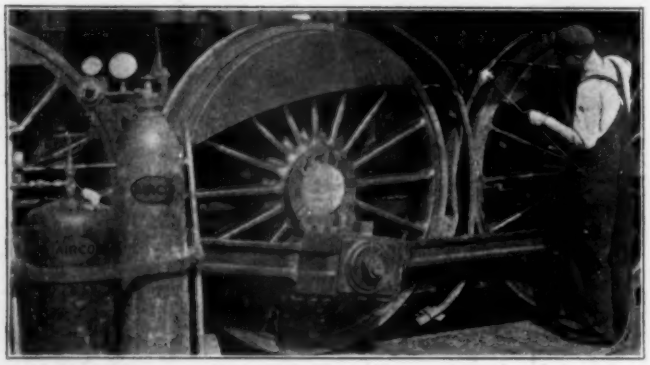
As a result of these six experiments I am convinced that the neutral flame should be used in welding aluminum at all times. It should be understood that the flame should be a reducing flame rather than an oxidizing flame.

Earl J. Thompson, Instructor in Oxy-Acetylene Welding, Y. M. C. A. Automobile School, Denver, Colo.

WELDING A WORN DRIVING WHEEL FLANGE.

The value of oxy-acetylene welding is becoming more and more evident in every industry where repair of machinery is necessary. One of the recent examples of the economical advantages of the process is shown in the repair of a worn driving wheel flange on a passenger locomotive of one of the large railroads.

The flange in question had been badly damaged by contact with a defective brake shoe.



Side Rods Not Removed.

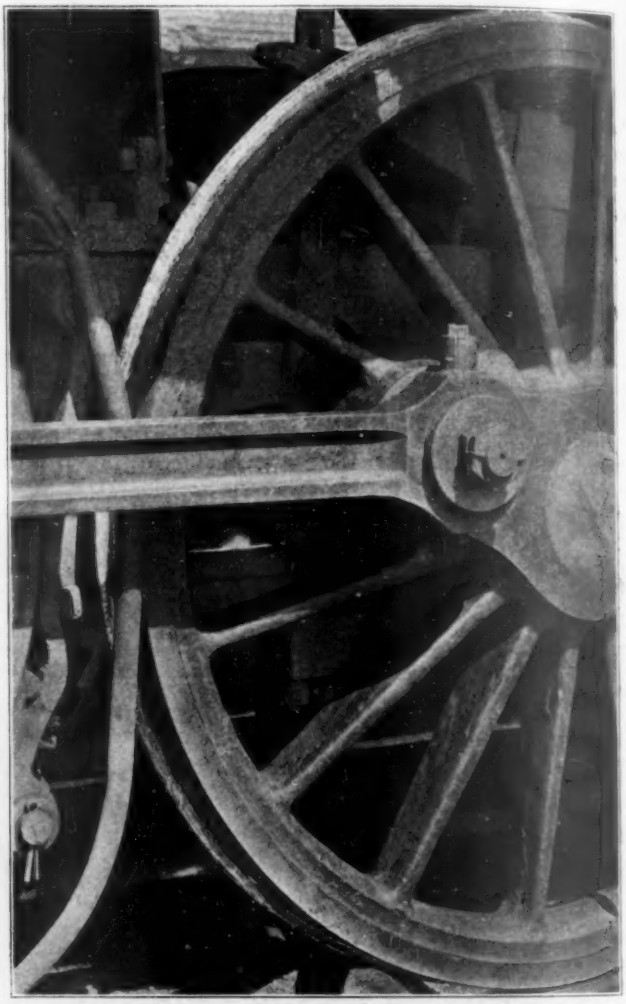
Ordinarily in a case of this sort it is good shop practice to turn down not only the worn tire, but the other tires of the locomotive as well in order to reduce all to the same diameter; or else, if they have already received their maximum number of turnings, replace them with new tires. This work is expensive. A week is usually required to remove machine and replace the driving wheels. A longer time is necessary where new tires are applied.

In this particular case the tires had received their last turning, making it impossible to repair the flange this way. To renew the wheels with an entire new set of tires would have meant the waste of about six months' wear still obtainable from the old tires.

The master mechanic in charge of the railroad shop decided that the worn flange could be built up by their welding torches and accordingly set to work to repair the flange, leaving the driving wheel in place under the engine. The worn flange was on one of the rear driving wheels.

The side rods were removed, and rollers ordinarily used for setting valves were placed under the wheels in order to revolve them as the welding work progressed. After the weld was finished the flange was ground with a portable surface grinder.

The work took twenty hours, the engine being put back on its regular run at the end of that time. Several weeks of locomotive service were saved, not to mention several hundred dollars in actual money which the master mechanic netted for his railroad. The details of the cost of oxygen and other supplies as compared with the cost of replacing



Flange After Welding.

the driving wheels are interestingly noted as follows:

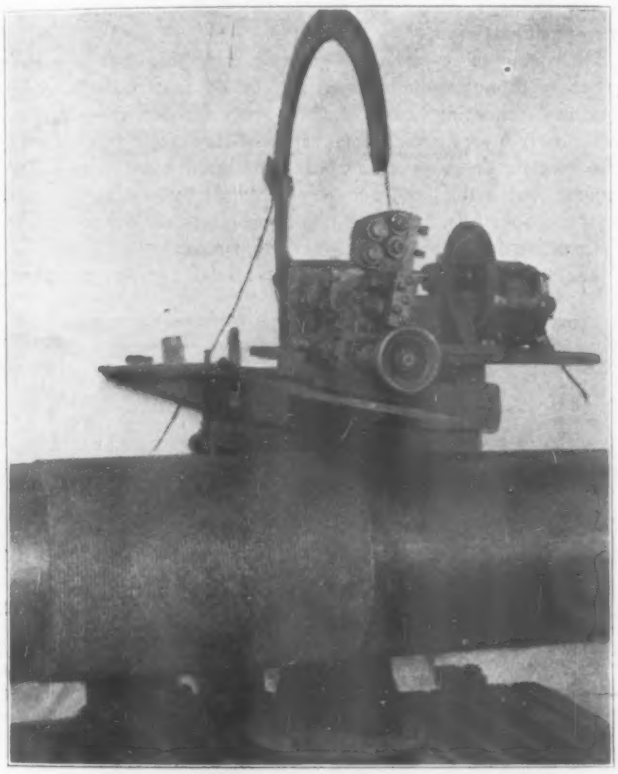
Oxygen	$ 5.00	
Acetylene	8.75	
Welding rod	3.00	
Labor of welder and two helpers	22.64	
Total cost of welding	$39.39	
Value of six 72-inch diameter driving wheel tires with a period of life equivalent to that of the six worn tires on the locomotive, cost of replacement, etc.		$625.00
Scrap value	$90.00	
Cost of welding	39.39	129.29
Net saving		$495.61

The welding of the tire took place over five months ago. The locomotive has been in continuous operation since that time. When inspected recently it was found that despite the strain to which this part of the wheel is subjected, the welded flange showed no more than a normal amount of wear. Airco apparatus and gas was used.

AUTOMATIC ARC WELDING

Automatic arc welding is now accomplished by a new device perfected by the General Electric Company, and soon to be put on the market, which is known as the Automatic Arc Welder. This welder, for use with the regular welding set, is designed to take the place of the hand controlled electrode. It consists of a pair of rollers, called feed rolls, driven by a small direct current motor, which draw in, and deliver to the arc a steady supply of wire, and automatically maintain the best working distance. The whole is controlled from a small panel.

The welding head is held by a suitable support with a certain amount of hand regulated adjustment, and consists of a steel body carrying feed rolls and straightening rolls which are both adjustable for various sizes of wire. The arm is supported on a gear box, together with the motor. This box contains gears which give three gear ratios, thus extending the



Automatic Arc Welder.

range of the device while allowing the motor to operate at its most favorable speed.

The control panel carries an ammeter and voltmeter for the welding circuit, as well as rheostats, a control relay, and the contactors and switches for the feed motor. It is possible to start and stop the equipment from the work by a pendant push button, but adjustment of the feed conditions must be made from the panel.

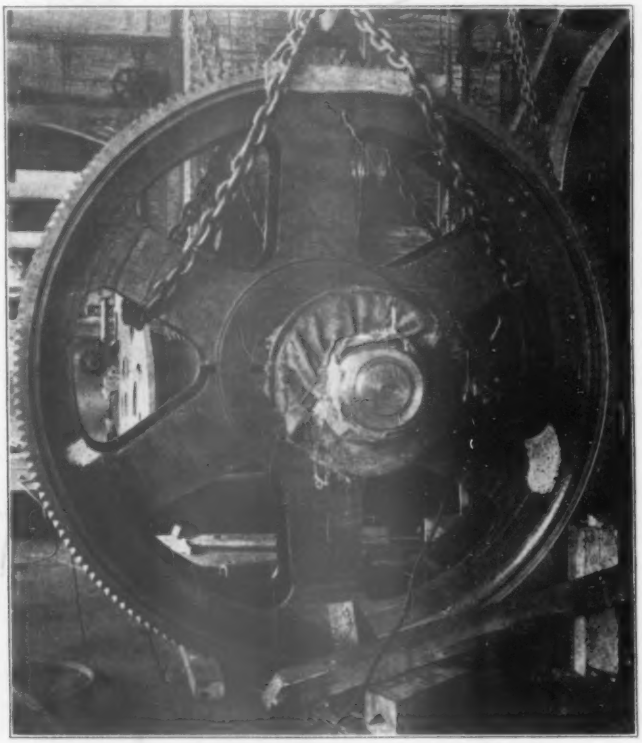
The adjustment for arc conditions by regulation of the speed of the feed motor, as the arc voltage varies, is taken care of by the panel equipment. The result is a practically steady arc, which is greatly superior in smoothness of operation to any hand controlled arc, consequently increasing the speed of welding.

The whole apparatus is mounted on a base which can be bolted to any form of support. Thus a great variety of working conditions can be met, but provision must be made for carrying the arc at uniform speed along the weld. For instance, for straight seams, a lathe or planer bed may be used, and for circular ones, a lathe or boring mill. However, the local conditions will dictate the method to be followed.

The device is especially valuable where a large amount of routine welding is to be done, since it is capable of from two to six times the speed possible to skilled operators and gives a uniform weld of improved quality. It is adaptable to welding seams of tanks and plates, rebuilding worn or inaccurately turned shafts (as shown in the illustration), rebuilding worn treads and flanges of wheels, and many other kinds of work.

WELDING A TURBINE GEAR

The accompanying photograph shows how the electric arc welding process saved a valuable herring bone turbine gear. This gear which is part of the equipment of the Steamship "Belfort" is 8½ feet in diameter and has a 24-inch face—it weighs approximately eight tons. The wheel is a double flange, double spoke construction and is made of cast steel.



Welded Turbine Gear.

It was previously welded by the arc welding process, but broke in the weld. In making the repair, the Electric Welding Co. of America, had first to cut out all the welding material that had previously been deposited and reweld it, that is why the welds are so wide. The cracks did not extend into the rim, being in the spokes only.

This work was done without preheating and saved from the scrap heap a gear that was worth between $7,000 and $8,000.

IMPROVED ELECTRODE HOLDER FOR CARBON WELDING

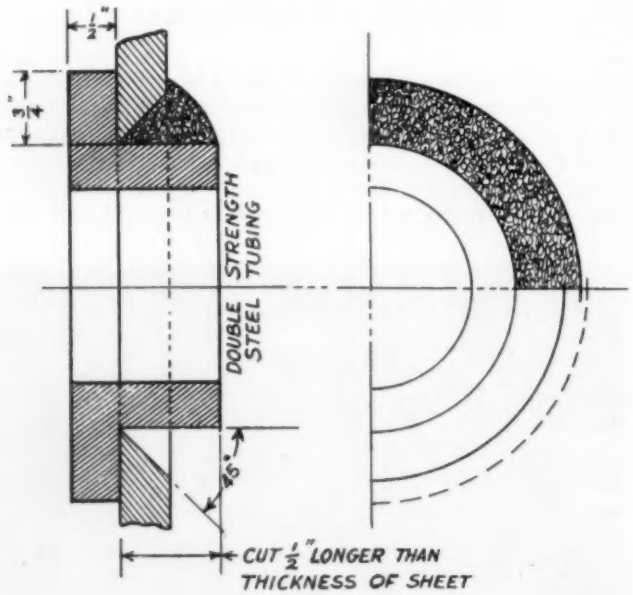
A new welding and burning holder has been patented by B. W. Bowers, of Easton, Pa., which will soon be placed on the market.

It is designed for carbon welding and burning only, and is the result from years of practical experience.

Its principal features are sound construction, thorough insulation and the elimination of absorbing heat to a minimum, which assures the operator sufficient comfort and safety.

K. C. RY. WELDING STANDARDS

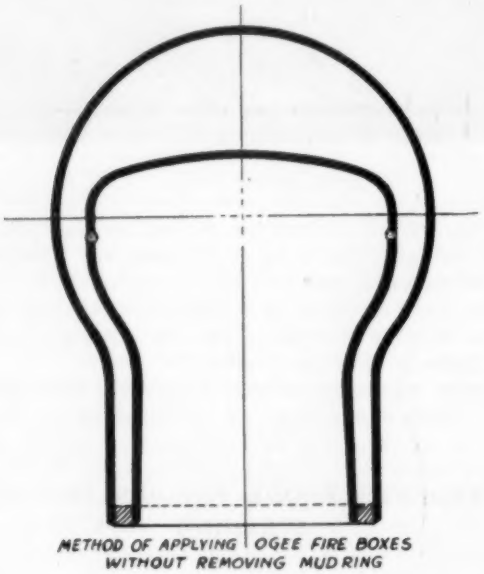
In the September issue of *The Welding Engineer* was published some information relative to welding practice in the shops of the Kansas City Southern Ry., the standards being worked out by Mr. G. M. Calmback, welding supervisor. These standards have been modified, we are advised, to the following extent:



Method of Fitting, Preparing and Welding Firebox Without Removing Back End.

Firebox should be set up on floor with all staybolt and mud-ring rivet holes applied, except mud-ring corner holes, which should be drilled after sheet is laid up and welded.

Welding edge should be chipped to a 45° angle and chipped on a straight line so as to insure a uniform opening between welding edges of ⅛ inch.



Lower portion of sheet from a point about 14 inches from bottom of flue and door sheet should not be chipped until box is in place and mud-ring corners laid up in place.

Bolt sheet securely in place, being sure that there is a uniform opening of ⅛ inch all around welding edge.

Use a ⅛-inch drill and drill holes spaced about 14 inches apart, and use ½-inch machine bolts with clamps made of boiler plate ½x2x4 inches, using one of these pieces on both sides of sheet, being sure that all bolts are drawn tight. See page 10-A.

Rivet top of flue sheet to a point not less than 12 inches below center of crown, start welding at a point about 10 inches below rivet and weld up to rivets. Then drop down 10 inches and weld up to end of previous weld. Continue this operation until completed, removing clamps when necessary, weld entire door sheet.

For Ogre Firebox Type

Use same method as above. The weld at side and crown sheet shall not be less than 12 inches below center of crown and should be welded before flue and door sheets are fit up.

ELECTRIC SOLDERING IRON

The electric soldering iron, when compared to the type heated in a gas flame, or fuel burning muffle, exhibits improvements, both in operation, and convenience which should make its adoption in garages, shops, and for plumbers, etc., a matter for serious consideration.

The ordinary type is, as a rule, anything but economical, either from a standpoint of time, or of material. It requires continual reheating, since it chills very quickly from radiation, and nearly every time it is reheated the timing is destroyed. The electric iron, once heated, remains hot as long as it is needful, but it does not become so hot as to oxidize the tinning, or the copper. In fact, the point is "calorized," or given a special coating to protect the copper from oxidation.

Due to the fact that it does lose heat rapidly, the average

Electric Soldering Iron.

soldering iron is made with a very large, heavy copper element, usually none too securely fastened on an iron rod, with a light wooden handle. The consequence is that it is awkward and tiresome to use, has no balance, and, for working in corners or similar places it is, for anyone except a really skilled operator a source of considerable annoyance.

The electric iron made by the General Electric Company has a handle that is a spiral of heavy wire, which gives a certain degree of flexibility, and at the same time gives the iron a good balance, and a firm connection to the copper section.

Another thing that makes the gas heated iron more or less undesirable, is the attendant fire risk. Gas flames are subject to blowing back, and thus causing fires; or even exploding, and the average fuel burning muffle is at best smoky, inconvenient and far from economical. The iron itself, if laid down on a bench or the like, has the hot copper in direct contact with the wood or the bench, and, owing to its unbalanced construc-

tion, has a tendency to roll off onto the floor, where it may easily start a fire. On the other hand, the electric iron can be quickly attached to any lighting circuit, and its constant heat is assured. The spiral handle is expanded into a guard ring where it joins the tip, that has the effect of raising the hot part in the air, when the iron is laid down, thus preventing it from setting anything on fire. In fact, from the standpoint of safety, convenience in handling, and economy of time and material, the electric iron is immensely superior, for light, or intermittent work, such as is done in automobile repair shops and garages, to the fuel heated type.

AMBRINE FOR BURNS

The National Safety Council reports figures from Washington showing that while 200,000 Americans were injured in battle, that during the same nineteen months, something over two million men, women and children were so seriously injured by accidents, here in peaceful America, that they lost over four weeks' time, or were permanently maimed.

Probably no class of industrial accidents causes greater distress or greater loss of time than the accidents which result in burns and scalds. Statistics from the State of Pennsylvania alone, show that out of 184,844 accidents during one year, 12,394 resulted in burns.

Heretofore there has been no standardized treatment for these distressing accidents which often leave the injured with disfiguring scars and contracted joints, and cause great loss of human life.

But a discovery brought out during the war has made the treatment of such accidents a simple matter. This treatment is being very popularly adopted in industrial plants everywhere. It is called "Ambrine" and is not only for burns and scalds, but for surface wounds of all kinds. Statistics show that 60 per cent of industrial accidents require this treatment. It is a medicated paraffin wax which is supplied in solid form and is simply melted to 150° F. and painted or sprayed direct to the wound. It completely excludes the air and consequently relieves the pain and shock at once. Having a wax base it does not adhere to the wound and can therefore be removed without causing bleeding and without disturbing the newly formed tissues. The heat which this wax maintains draws the blood to the surface and new skin develops with surprising rapidity.

Recent cases on record show that scalds covering four-fifths of the body have been healed without scars or functional disability—thereby refuting the idea that if one-half of the body is burned, the patient cannot be saved.

This treatment is so very simple that anyone can use it, and the Ambrine Laboratories, 347 Madison Avenue, New York City, are supplying emergency cases which contain the full equipment, so that anyone can apply the treatment as a first-aid measure and secure uniformly good results.

In the welding industry these emergency cases seem especially appropriate and their use will not only spare pain and save lives, but by restoring workers to their tasks in half the time ordinarily required, much will be saved in compensation by their use.

PAGE STEEL & WIRE ACQUIRED BY AMERICAN CHAIN

The American Chain Co., Inc., of Bridgeport, Conn., has purchased the control of the Page Steel & Wire Co., with mills at Monessen, Pa., and Adrian, Mich.

It is the intention of the American Chain Co. to continue the business of the Page Steel & Wire Co. as heretofore, taking only its surplus product.

The Page Steel & Wire Co.'s plants consist of open-hearth furnaces, rolling mills, wire mills, as well as fence factories.

The new officers elected under the reorganization of the company are: Walter B. Lasher, president; William T. Morris, vice-president; Wilmot F. Wheeler, treasurer; John E. Carr, assistant treasurer, and William M. Wheeler, secretary.

E. C. Sattley, general manager of the Page Steel & Wire Co., will continue in that capacity with offices in Pittsburgh, Pa.

The American Chain Co. has its general sales offices in the Grand Central Terminal Building, New York City, and district sales offices in Chicago, Boston, Philadelphia, San Francisco, Portland and Pittsburgh.

Second and third degree burns on face and hands. Patient received March 22nd.

Note the improvement through AMBRINE treatment. April 5th.

Complete recovery without scars or functional disability. May 15th.

It is expected that a Chicago Chapter of the American Welding Society will be organized shortly. Thousands of welders are employed in and around Chicago and the manufacturing and supply trade is also well represented in this territory. A local organization should therefore serve a very useful purpose.

PERFECTYPE TORCHES

W. B. Perdue, 1220 Post Street, San Francisco, Cal., has announced his latest cutting and welding torch, Type A. The new torch provides a welding torch of light weight and proper balance and is recommended to cut metal up to 20 inches. It operates on acetylene, hydrogen or other fuel gases. Economy in gas consumption is a feature and a patented tip construction insures clean, regular and narrow cuts. The change from cutting to welding or decarbonizing torch is made instantly and if desired without changing pressures at regulators. It may also be used for very light or very heavy work, an extension giving the torch a 33-inch length. The cutting oxygen trigger may be removed when welding, if desired.

Type "A", Perfectype Torch.

A novel method of numbering tips has been adopted. Twice the number of an acetylene tip represents the thickness in inches of the heaviest metal it will cut. Hydrogen tips have large preheating orifices and will cut metal three times the thickness in inches of the number on the tip.

ADVERTISING THE JOB SHOP

Editor:

Having read with considerable interest your articles in reference to job shops which advertise, and having a few ideas along those lines ourselves, we take pleasure in submitting a few clippings which are the entering wedge of a campaign which we are planning to carry on in the northern part of California.

Our business is in its infancy, having opened the doors only a week ago, but there is no doubt of our success as we have a field full of heavy lumber-working machinery and autos, and which has to date not been worked at all.

The equipment includes all of that which was in use in our former location, the Vallejo Welding Works, Vallejo, Cal., of which A. E. DeBurn was the manager, and P. W. Westfall was the silent partner, he being employed at Mare Island Navy Yard as leading man welder gas. In addition to the above-mentioned equipment we are planning on installing one single unit direct-current electric outfit, and augmenting our preheating outfit by the addition of a Wiederwax preheater.

Under the head of the Vallejo Welding Works we wrote you suggesting that you outline an advertising campaign which could be followed by small shops which could afford no advertising man, and you replied that you were working along those lines. We hope you are now in a position to assist us in putting our plant before the public.

At present we are carrying front page with one and inside position ads with the other local paper, both having a circulation of about 5,000 in town and an equal amount of out-of-town subscribers. We are also carrying eight inches weekly on the front page of the *Labor Leader*, a strictly union publication devoted to the welfare of union members in Humboldt County, and having an extensive circulation among the mill and lumber men of the Northwest.

In addition to our paper ads, we are running slides in the two largest photo-play houses in town, both with a seating capacity of 500 or over and playing to capacity houses all the time. They give us three slide displays daily and continuous on Sunday.

Our quarter cards are out, and posted in most of the garages and shops in town and we have made three of the outside towns. This and personal interviews seem to be good advertising and bring immediate returns. It is our intention, as soon as we can find the time, to make every garage in our territory with a personal talk and a card, but these trips will have to be made as we go out on jobs.

Our shipping tag bears an announcement on its reverse side which makes people read it, and has been responsible for some work already.

Our slides read as follows:

You know your old part was right—we will make it right again, and guarantee the job.

The carbon can be removed from your car through the spark plug holes by the oxygen process cheaply, quickly and efficiently.

Oxy-acetylene cutting and welding processes won the war against Germany and will whip old H. C. L. where metals are concerned. HAVE IT WELDED at E. W. Wks.

You'd be surprised at the possibilities of oxy-acetylene welding when done by expert mechanics. "Save the pieces."

Malleable iron castings play an important part in the construction of the modern automobile. In their repair the use of Tobin bronze enables us to guarantee our work.

Oxy-acetylene welding, brazing and cutting. Prompt service. Reasonable prices. Expert workmanship.

"Use the 'phone." We are prepared to go any place at any time for any job in our line which cannot be brot to us.

We weld all metals—cast iron, aluminum, brass, bronze, copper, steel, 'n everything.

Braze the boiler, solder the pot, weld the stove leg. What else you got? Something for nothing—expert advice.

There are other slides covering the motorcycle game and scored cylinders, but do not think it expedient to give them to you, understand?

Now any outlined plan or suggestion you might be able to offer will be greatly appreciated as we are trying to reach the large mill owners as well as the general job shop work.

Eureka Welding Works, Eureka, Cal.,
(Westfall & DeBurn, Proprietors.)

BIG DIVIDENDS
ARE PAID to the company which curtails its waste.

They do not scrap MACHINERY because it is broken, but put it in the hands of a competent welder to be REPAIRED.

Their LABOR LOSS is SMALL and men are seldom idle on account of breakdowns.

All these things are made possible by the oxy-acetylene process of cutting and welding metals.

Remember, when both machinery and income stop, that your needs will be promptly attended should you call on us.

We are never too busy to answer questions or look at your work.

USE THE TELEPHONE.
EUREKA WELDING WORKS
410 4th Street. Telephone 627

NEW ELECTRIC WELDING BOX

The electric welding box which is shown in the accompanying illustrations has been in use for some time past, at the Schenectady Works of the American Locomotive Co., in electrically welding superheater pipe supports, and has been found very satisfactory in operation. It is also being

Welding in the Open.

tested at the Mount Clare shops of the Baltimore & Ohio R. R. It is simple in construction, consisting of a sheet metal box, with sides and end shields, and an upwardly extending case or "cupola," in the top of which, colored observation glasses are fitted removably. The cupola is inclined at such an angle as will be adapted to bring the electric arc in the line of vision of the operator, when the work is in a waist-high position. Ventilators on the sides of the cupola carry away the gases developed in the welding operation, and the welding wire passes through a socket at the front of the box.

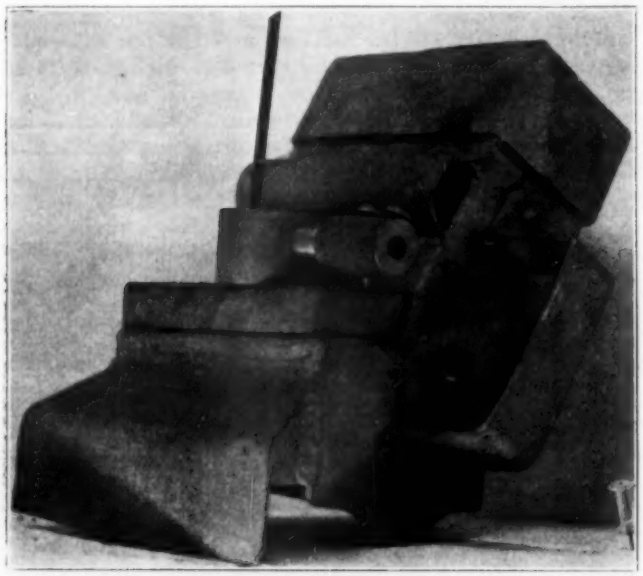
In the ordinary electric welding practice, the electrode is located in a holder which is connected to the source of current, and manipulated by the operator, who wears a helmet and observes the work through glasses therein, of suitable color, which act as eye pieces. The arc is not enclosed, and is consequently a source of danger to persons in the vicinity

Welder at Work with Case Covering the Arc.

of the operation, by reason of its injurious effect on the eyes. This objection is eliminated by the box illustrated, as the case covers the arc, while the weld is being made, thus cutting off the injurious light rays.

Among the advantages of this design, the following may be enumerated: The work is done under the cover of a case, giving protection to workmen near to it, and passers-by, from injurious rays of light, and the welding operation may be safely performed in crowded quarters or in the open street. A steady and positive support for the wire is provided, enabling the operator to maintain a constant length of arc, and minimizing personal and fatigue factors, thus effecting a stronger and more ductile weld. The operator is relieved from the helmet heretofore used, which tends to increase comfort and speed, and less experienced help may be availed of. In special repetitive work, the case will act as a jig for locating welds, and in the welding operation, the case and cupola become filled with an iron vapor which drives out the

air, permitting the weld to be made more durable, by reason of being done under conditions which minimize or eliminate the passage of oxygen or nitrogen into the welding metal.



Box-Shaped Electric Welding Case.

Any information desired as to this welding box can be obtained from its designer, Mr. Ralph P. La Porte, 636 Rugby Road, Schenectady, N. Y.

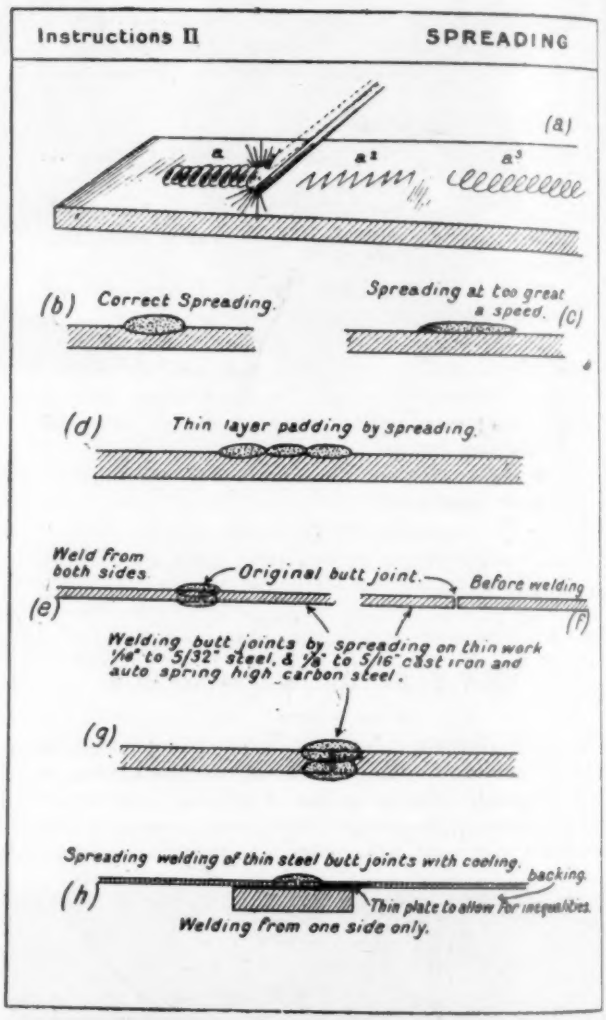
INSTRUCTIONS IN ELECTRIC ARC WELDING*

Spreading

Here the electrode is applied by moving the electrode from side to side, at the same time advancing, *i. e.*, back and forth in a zig-zag manner, as shown in Figure A, Instruction 2. The electrode must *not* be moved rapidly, *i. e.*, must not be moved faster than the arc can make the liquid bowl or crater, and must be moved at an even rate so that this crater becomes a trough into which the electrode material is deposited evenly. The rate of speed back and forth of the electrode must be the same rate as that used for the advance in running beads, and in fact each successive layer in spreading is simply crosswise beading done continuously and short in breadth; the welded metal becomes heated to such a point then that a greater speed is attainable than at first.

It will be noted that the completely covered slag-coated electrode lends itself admirably to this method; in fact, it is much easier to apply this electrode by spreading than by any other method, as the successive movements from side to side keep the puddle of deposited metal in the center as a river of metal with banks of slag, and as advance is made the banks of slag close over the metal a short distance behind the arc. With this electrode, however, in starting or restarting the cold slag must be chipped away, and it should be noted that the slag must be cold, *i. e.*, black, before it can be chipped away. In merging the spreaded beads with these electrodes the edge to be merged must be chipped clean, else there is almost a certainty of slag inclusion in the weld. In spreading with a flux-coated electrode the bare side should be kept pointed towards the parent metal, and it will be noted that the flux coating forms an insulating dross, so that with a close arc it is a natural tendency to advance at the edge of the previous layer or bead, and not to back up on the already deposited metal. With bare wire there is no such aid, and special cares must be taken to not bridge over or leave void in this method of spreading, *i. e.*, bare wire is least applicable to this method and completely coated wire is most applicable, while the half-coated flux covered lends itself to either spreading or padding by beads.

Correct spreading is shown at Figure B, with the welded metal sunk in, or as the experienced welder terms it, bitten into the parent metal. Spreading with too long an arc results in the deposited metal simply lying on the parent metal as at C, with no biting in effect. Figure D shows how padding can be accomplished by spreading, care being taken, of course, to merge the spread layers into each other, and it will be noted that this



method is more applicable to a small amount of beading, whereas beads are more applicable wherever the surface has to be raised higher. In general more heat, and hence with the same length arc more current, can be used in spreading than by any other method, and as speed or rate of deposition of the metal with the arc at constant length depends on the current, greater speed can be made by spreading than by any other method. This is because the parent metal is advanced over at a more rapid rate, and hence a greater rate of heat in the arc can be taken care of by the weld conducting the heat of the arc into the parent metal. It is this action of heat conduction by welding, as explained in page 80 by article entitled "Temperature and Heat of the Arc," that allows of the high temperature of the arc to be the correct resultant mass temperature for molten iron and other metals. The fact that a weld is made conducts

**Instruction No. 2, from the handbook of the Electric Arc Cutting & Welding Co., 222 Halsey St., Newark, N. J. Copies of the complete instruction book may be had from this company at $1.25 each.*

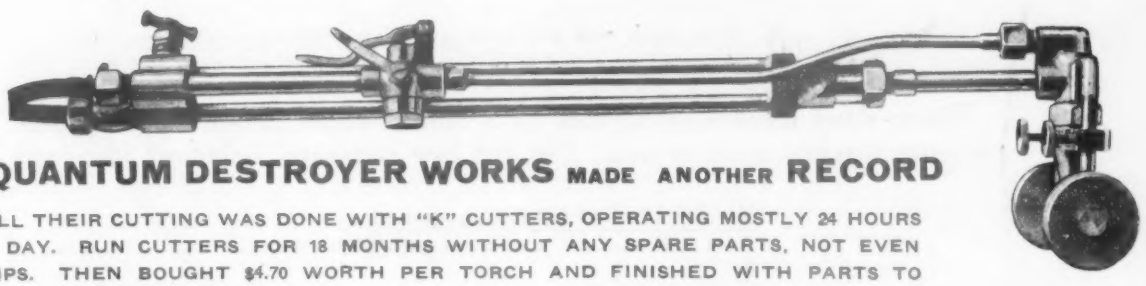
GENERAL WELDING & EQUIPMENT CO.

G.W.E.C.

107 MASS. AVE. BOSTON, MASS.

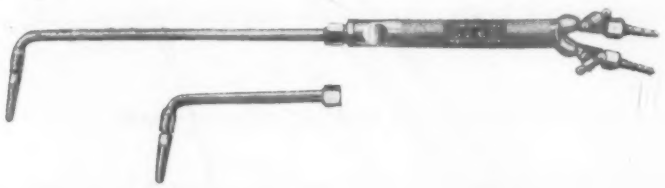
THE FAMOUS "K" CUTTING TORCH

MANY THOUSANDS OF THESE TORCHES SOLD BY US AND THE **PRESTOLITE.** IMMEDIATE DELIVERY OF TORCHES AND SPARE PARTS. SEND YOUR **PRESTOLITE K**-CUTTING BLOWPIPE IN AND WE WILL FIX IT UP WITH OUR LATEST IMPROVEMENTS.



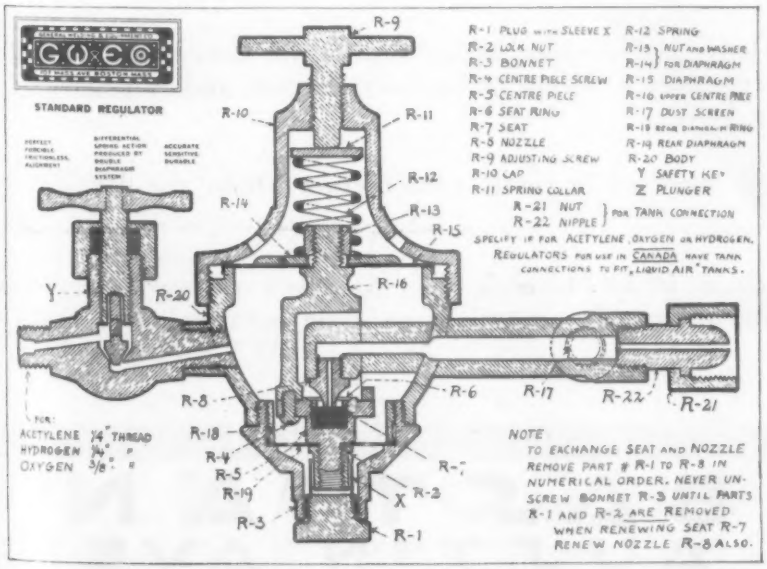
SQUANTUM DESTROYER WORKS MADE ANOTHER RECORD

ALL THEIR CUTTING WAS DONE WITH "K" CUTTERS, OPERATING MOSTLY 24 HOURS A DAY. RUN CUTTERS FOR 18 MONTHS WITHOUT ANY SPARE PARTS, NOT EVEN TIPS. THEN BOUGHT $4.70 WORTH PER TORCH AND FINISHED WITH PARTS TO SPARE. SOME RECORD!



STANDARD WELDING TORCH STYLE "W"

THIS IS NO EQUAL PRESSURE TORCH, NOR A BALANCED PRESSURE ONE, NOR A TIP-MIXER, ETC.; IN SHORT IT IS FREE FROM ALL AND EVERY NOISY ACCOMPLISHMENT. IT USES JUST ENOUGH PRESSURE TO SAFEGUARD THE OPERATOR. IT WORKED WITHOUT FLASHBACKS LONG BEFORE THOSE NEW DISCOVERIES WERE BORN. IT IS USED BY THE MOST PROMINENT CONCERNS. EACH TORCH IS FURNISHED WITH A SHORT EXTENSION TO HAVE A 16-INCH LONG TORCH, AND A LONGER EXTENSION TO HAVE A 22-INCH LONG ONE THUS YOU REALLY HAVE TWO TORCHES IN ONE.


STANDARD REGULATOR
R-1 PLUG with SLEEVE X
R-2 LOCK NUT
R-3 BONNET
R-4 CENTRE PIECE SCREW
R-5 CENTRE PIECE
R-6 SEAT RING
R-7 SEAT
R-8 NOZZLE
R-9 ADJUSTING SCREW
R-10 CAP
R-11 SPRING COLLAR
R-12 SPRING
R-13 } NUT and WASHER
R-14 } FOR DIAPHRAGM
R-15 DIAPHRAGM
R-16 UPPER CENTRE PIECE
R-17 DUST SCREEN
R-18 REAR DIAPHRAGM RING
R-19 REAR DIAPHRAGM
R-20 BODY
Y SAFETY KEY
Z PLUNGER
R-21 NUT
R-22 NIPPLE
} FOR TANK CONNECTION
SPECIFY IF FOR ACETYLENE, OXYGEN OR HYDROGEN.
REGULATORS FOR USE IN CANADA HAVE TANK CONNECTIONS TO FIT LIQUID AIR TANKS.
FOR ACETYLENE 1/4" THREAD
HYDROGEN 1/4" "
OXYGEN 3/8" "
NOTE
TO EXCHANGE SEAT AND NOZZLE REMOVE PART # R-1 TO R-8 IN NUMERICAL ORDER. NEVER UNSCREW BONNET R-3 UNTIL PARTS R-1 AND R-2 ARE REMOVED
WHEN RENEWING SEAT R-7 RENEW NOZZLE R-8 ALSO.

DOUBLE DIAPHRAGM REGULATOR

MOVABLE CENTERPIECE R-16 CARRYING SEAT R-7 IS NOT ONLY FASTENED TO MAIN DIAPHRAGM R-15 BUT ALSO TO PERFORATED REAR DIAPHRAGM R-19 THUS ENFORCING AN ABSOLUTELY STRAIGHT AND FRICTIONLESS UP AND DOWN MOVEMENT OF SEAT R-7. REAR DIAPHRAGM R-19 ALSO ACTS AS A SENSITIVE DOUBLE WAY SPRING, THUS INCREASING SPEEDY ACTION OF MAIN DIAPHRAGM R-15 AND PREVENTING IT FROM BEING OVERSTRAINED AND FROM BUCKLING.

NO OTHER REGULATOR HAS THESE REMARKABLE FEATURES.

WELDING AND C

REGO Makes Welding Histor

Remember the claims various builders of torches made just a couple of years back

"Our torch will not flash if—unless—but—provided—except—"
And you were told a dozen or more things you must not do.

Those days there was no talk of a torch which balanced the gases. Of course e pressure torches were in use. But **the low pressure, balanced idea was unknown.**

In June, 1918, REGO was announced.
Jeers, sarcasm, ridicule, scorn greeted its claims.
But

Have you noticed lately how many torch manufacturers are claiming they have e nated the flash back, low pressures of both gases, less oxygen consumption—Rego d **and Rego patents?**

Like all pioneers, REGO has had to fight both apathy of users and piracy of competi

The tremendous growth of this Company's torch and apparatus business is ample p that the REGO principle is correct.

Of course you can buy imitations, but REGO, **the Pioneer in balanced pressures elimination of the flash,** leads in many other features over its imitators.

The engineering knowledge and the mechanical skill of this Company insure the purch of REGO torches and regulators a design technically correct and a product mechani excellent—and at a right price.

There was a real stride forward in torch construction when the REGO was bro on the market.

If you don't know all about REGO torches, their time and money making qualities, t perfectness of mixture and their truly neutral flame, send for our literature.

THE BASTIAN B
WEST AUSTIN AVENU

TING APPARATUS

GO MODEL "L" WELDING TORCH

r Acetylene (tank or medium pressure generator)

Many call this the "All-Purpose" torch, since it will handle every welding job from light sheet metal to heavy castings.

Measures 22 inches over all.

Furnished with ten (10) nickel-copper tips.

The famous R E G O Model L welding torch for all classes of work.

Complete with 10 nickel, copper tips	$40.00
Torch alone	20.00
Tips, each	2.00

Our catalog illustrates, describes and prices a full line of welding and cutting torches ranging in price from $6.00 to $80.00. ASK FOR IT.

SSING COMPANY

LA SALLE STREET CHICAGO.

the heat away, and, if a weld was not made, as would be the case in depositing steel on a copper plate, the deposited metal would be burned beyond recognition at a rate of heat which would be perfectly correct when welding into steel. Sketches E. F and G. Lesson 2, show an application of spreading to a butt joint on thin work. By thin work is meant from 1/16 to 5/32 inch steel, and ⅛ inch to 5/16 inch cast iron, or high carbon steel, such as an automobile spring. Work as thin as 1/16 of an inch should be backed up as in Figure H with a cold mass, such as another piece of steel or a water-pad, so that the metal when molten for welding will not fall through. If the piece is of such thickness as in E and G that the spreading will not melt the edges so as to fall through, a spread can be put on both sides which will merge in the center as shown, and weld without any preparation of the joints. Automobile springs being about 3/16 inch to ¼ inch thick can be welded sucessfully in this manner and the excess metal of the spread ground off. The reason spreading is used for this comparatively thin work is the phenomenon that in proceeding with a bead the edges become too hot and fall through, whereas, in lacing back and forth as in spreading more of the heat is carried into the parent metal.

In spreading with heavily slag-coated electrodes, direction of travel as Figure A-a2, should be followed and with bar wire or flux-coated electrodes travel as A-a3 can be followed or other designs after experience has been attained in merging.

There is also open, as a solution to the welding of thin work, the use of an electrode which melts at a lower temperature than the metal to be welded, so that the slighter mass of the metal to be welded allows of the melting rates being made more equal.

CAST IRON WELDING

By W. G. Owen

To successfully weld cast iron the following suggestions will be found helpful.

First: The Preparation of the Weld.

I have found in my experience that 50 per cent of a successful weld depends on the preparation of the weld and the selection of a suitable filler rod. When the parts to be welded are over ¼ inch in thickness it is always advisable to chamfer the line of weld at an angle of about 45 degrees. This is usually done with pneumatic hammer and chisels, provided the part to be welded will withstand the vibration. A skilled operator will often burn out, or V, his line of weld. This practice is all right if care is taken that the flame used for chambering is positively neutral. Too many operators will endeavor to hasten the operation of chamfering by using a flame with an excess of oxygen. This is very injurious as it forms slag in the line of weld which will afterwards have to be floated out of the weld. So great care should be taken that the flame is neutral when burning out the V. An advantage gained, if the flame is neutral, in burning out the line of weld, is you will rid the metal of oil or grease. Cast iron being porous will absorb the oil and grease and when the metal is welded the oil will form a gas which in escaping will leave pin holes in the weld greatly weakening it. So great care should be exercised in the removal of all oil and grease before the welding operation takes place. In chamfering out the parts to be welded where they will be welded from both sides, necessitating two operations, always chamfer the side where the first operation is to be done a little over half way. This will keep the part from pulling out of line should some contraction take place before both operations are completed. And remember, you cannot have your weld too clean, so be sure your parts are as free from oil, grease and any other impurities as you can make them before starting the welding operation.

Under this heading, the preparation of the weld, also would be classed the preheating of parts to be welded. This is one of the most important points in the successful welding iron parts. Preheating is necessary where the castings are of such a shape that a suddenly applied heat on a certain point will cause a warpage or where there is not a free end for the expansion and contraction to take place.

In the welding of auto cylinders, small pump cylinders and other spherical shapes the parts, after being thoroughly cleaned and chamfered, should be brought to about 500 to 600 degrees Fahrenheit, which should be found sufficient. In the welding of large cylinders and spheres 900 to 1,000 degrees Fahrenheit are all required. Should you build a furnace around the part to be welded be very sure that your flame used for preheating, especially if air pressure is used in conjunction with the preheating flame, does not play on your casting. It it plays directly on a part of the casting it will cause uneven heating causing warpage. Have your flame so placed as to slowly and evenly heat your casting and bring all parts of the casting to the same point of heat at the same time. Care should be taken to so regulate your preheating flame that the heat radiating from the welding operation will not cause the casting to become heated to too high a point as warpage will be the result. Preheating is something that must be left to the knowledge and experience of the operator as some operations require but slight preheating while others require the limit. But always remember that parts heated too highly will warp.

Second: The Selection of a Proper Filler Rod.

You cannot exercise too much caution in selecting a filler rod. Always get the best. A dirty inferior rod will mean waste of gases, waste of time, and an inferior weld, no matter how skilled the operator. As your heat has a direct effect on the carbon and silicon contained in the filler rod, lowering or burning out a percentage of both the carbon and silicon, special attention should be paid to the amount of silicon and carbon contained in the rod. Therefore, the carbon and silicon content of the rod should be comparatively high. A clean, high silicon rod is the best.

Third: The Selection of a Proper Size Tip.

Be sure and select a tip large enough. I say large enough because there seems to be a tendency to select too small a tip and try to overload or crowd it. This is a bad practice as it causes flashbacks and also localizes the heat to such a small area that it radiates too quickly thereby chilling the line of weld, making a weld hard to machine. Also you will have difficulty in controling your metal when it is in a fusing state as it will be blown on the cold parts of the line of weld, causing an inferior weld. By using a tip large enough and not crowding it you will have no difficulty with controling your metal when in the fusing state.

Fourth: The Regulation of the Welding Flame.

Be sure your flame is neutral. An excess of oxygen means oxide films and slag pockets. An excess of acetylene means pin holes. In both cases a weakened weld. If you carry an excess of acetylene the metal when in a molten state will take up, or absorb, the excess acetylene gas and when it escapes in the cooling, or solidifing of the metal would leave pin holes. Such is also the case when the weld is not cleaned of all oil and grease. So always use a neutral flame.

Fifth: The Welding Operation.

After the casting or part has been preheated to the proper temperature apply the flame to the bottom of the V. Be sure and fuse the bottom of the V first at the same time heating your sides and bringing them up to a point of fusion, then apply your filler rod, breaking up your oxide film and raising your impurities with the filler rod. Always be sure to raise all impurities to the top of the weld where you can float or lift them off. Do not push the impurities to the edge

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WELDING

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One of the best means of effecting economies and stimulating production, as often pointed out by efficiency experts, is the use of **welding.**

Although a vast amount of welding is now being done, there are still innumerable places where welding should be used, both in the manufacturing plant and the repair shop, and to those who have not as yet realized the advantages in welding we strongly recommend they immediately investigate this wonderful process.

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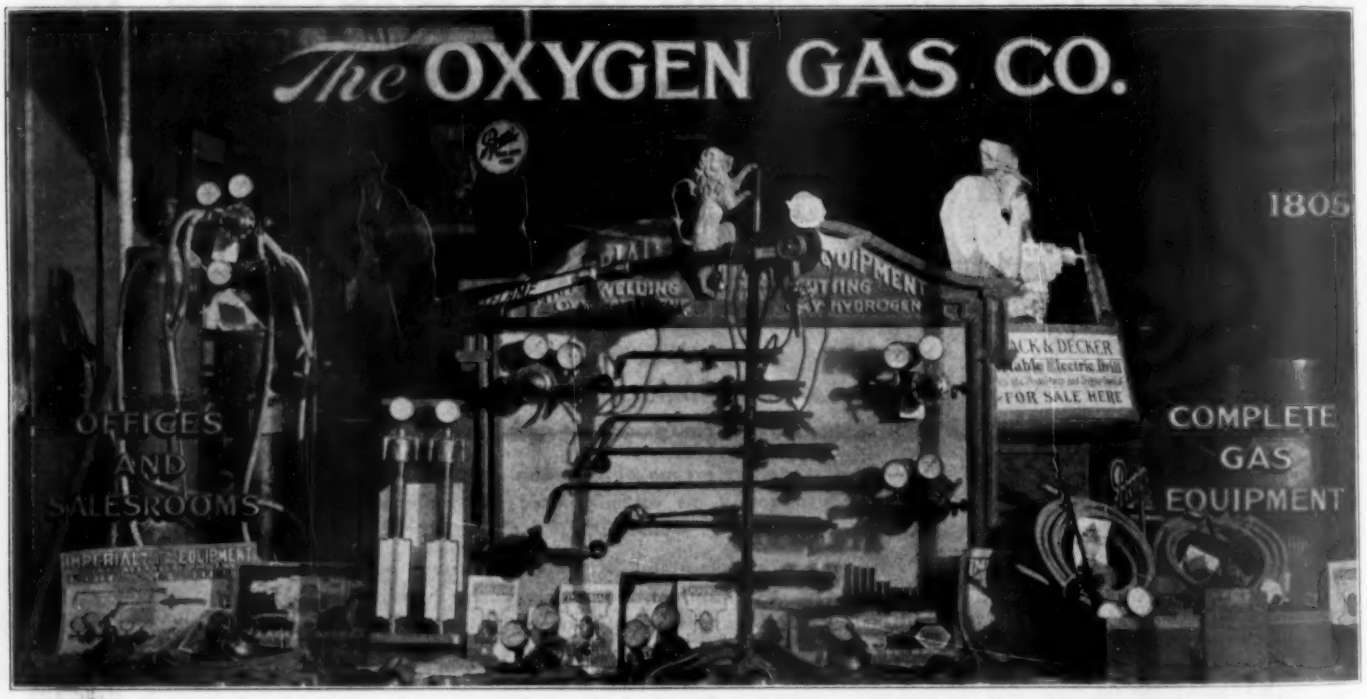
and let them lie there as they will leave hard spots impossible to machine. Lift them out and fuse the edge of your weld thoroughly. Do not play your flame any longer than necessary on one spot, as by doing so you are burning out properties impossible to replace. Keep an area on both sides of the line of weld at a high temperature so that the cooling process will not take place too rapidly. Do not use any more flux than positively needed. Your flux is simply to help break up the oxide film and dissolve the impurities.

Sixth: The Cooling Process.

This has more to do with making welds machinable than most operators imagine. If the above suggestions are carefully followed then the only reason for hard welds, would be rapid cooling. Rapid, uneven cooling will make hard welds, will result in warpage and make castings crack again after being apparently successfully welded. Whenever possible, the line of weld and an area on both sides should be brought up to about 1,000 degrees before being put away to cool. If you make sure your work will cool slowly and evenly there should be no reason why your welds should not be machined easily. Also you will have no trouble with warpage, strains and cracked castings. The slower and evener your castings cool the nearer your weld will be like the original metal of the casting welded.



Oxygen Gas Co.'s Attractive Window Display.

I hope these suggestions will be found of use to someone in the craft. Thanks to *The Welding Engineer* we have a medium through which we can exchange ideas and experiences and also profit by the scientific articles appearing in the columns of this magazine.

THE OXYGEN GAS CO.

One of the most progressive and enterprising concerns in the welding industry is the Oxygen Gas Co., Kansas City, Mo. This company was the first manufacturer of oxygen and hydrogen in the Middle West. They operate two plants and carry an extensive stock of gas, welding apparatus and supplies of all kinds for the welder. They also manufacture nitrous oxid for medical purposes and specialize in the installation of electrolytic oxygen and hydrogen plants. The accompanying illustrations show the down-town show room and widow display. Imperial apparatus is featured. John R. Foran is president; William H. Ehlers, vice-president and treasurer, and Parker B. Francis, secretary.

SELECTING METALLIC ELECTRODES FOR ARC WELDING

By F. V. McGinness*

In the majority of cases where metallic arc welding is in use on railroads, little or no thought has been given to the selection of proper metal for electrodes, outside of the initial cost. It would be well for the prospective purchaser to look into this matter further and realize that in purchasing welding wire you, in reality, should look upon it as purchasing an insurance against keeping engines in roundhouses and shops on account of recurring running repairs of the same parts, which work could be reduced to a minimum by the use of proper electrode material in connection with the metallic arc welding process.

There are many low-priced welding wires which contain such impurities, that it is difficult for even an expert operator to make the metals penetrate at the line of weld, due to the uneven flow of the metal or the result of a wild arc which impurities will create. It is found that operators supplied with such electrodes will scrap 25 to 50 per cent of it, due to the difficulty in maintaining an arc as well as difficulty of getting the metal to fuse at the weld. Such welding material will lack homogeneousness and weldability—two features absolutely necessary in electrodes if electric welding is to be successful. Due to the enormous wastage of this class of electrode, you can readily see that the purchase price of this metal is absolutely no indication of what you are paying for the metal used in the weld, which is what you are really paying for it. This class of metal will also form a brittle weld, which might show a fairly good tensile strength, but which would fail, due to repeated stresses, very easily.

If the complete cost to a railroad of a weld on an engine

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National Oxygen Co., Detroit
Burdett Oxygen Co. of Detroit, Detroit

MINNESOTA
Commercial Gas Co., Minneapolis

MISSOURI
Oxygen Gas Co., Kansas City (two plants in Kansas City)
St. Louis Oxygen Co., St. Louis

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International Oxygen Co., College Point, L. I.

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International Oxygen Co., Newark
Standard Oxygen Co., Hoboken

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Ohio Electrolytic Oxygen Co., Cincinnati
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Burdett Oxygen & Hydrogen Co., Pittsburgh
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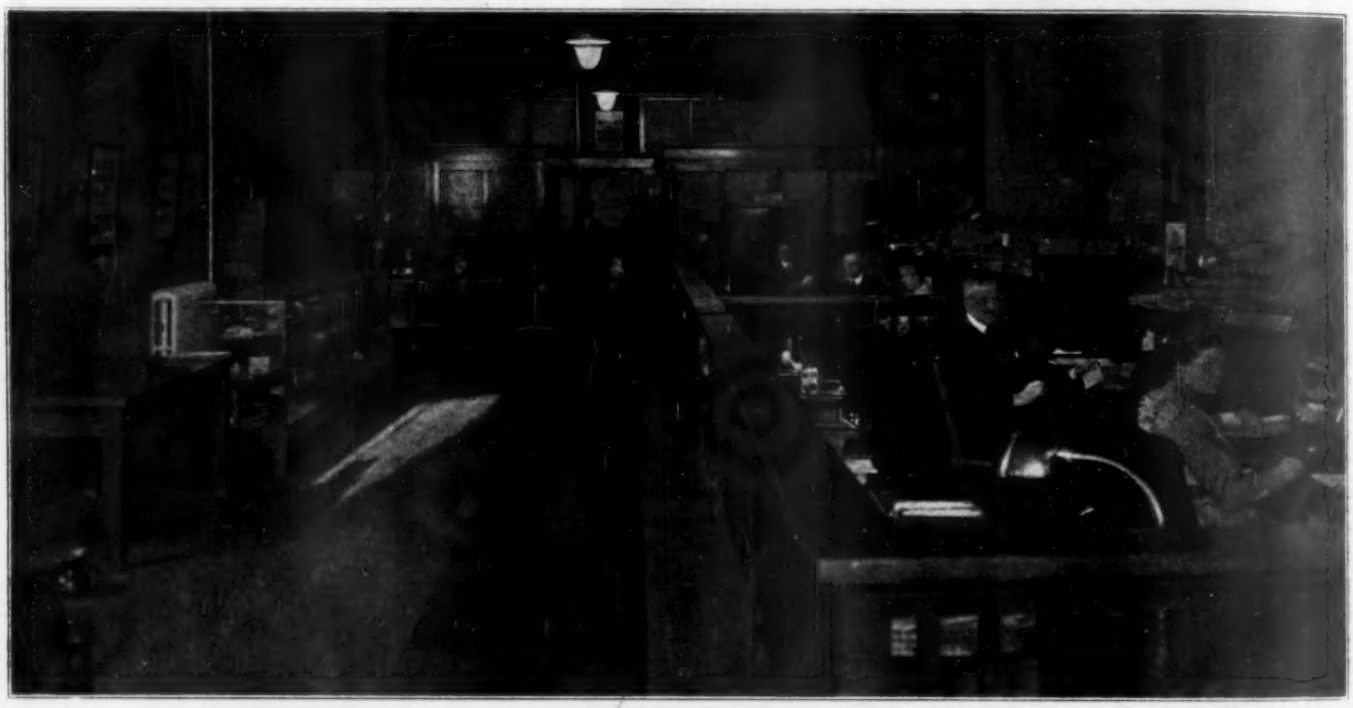
should be compiled, including labor, interest on investment, loss of earning power of engine due to layup and cost of material, there is no question but that the cost of the welding electrodes used on the job would not be in excess of 1 per cent of the complete cost of the job, yet the electrode material used may determine whether the weld will stand up or whether it will be back in the shops in a short period due to failure.

Practice has proved that the most successful welds and those which can be termed lasting successful welds are those whether the metal in the weld shows good penetration with the material welded and that has the important characteristics of toughness and ductility—also where the metal in the weld does not show a decided uniform crystalline formation on fracture. Such welds can be obtained by the use of a homogenous metallic electrode, particularly low in carbon, sulphur, manganese and phosphorus, so treated as to minimize the oxidation of the metal during the welding process. Such electrodes are obtainable and there is no question but that their use is doing more to insure the success of the electric arc welding process than any other single factor.



Down Town Office and Salesrooms, Oxygen Gas Co., Kansas City, Mo.

In all strength welds, and all welds made in railroad service are strength welds, the weld is usually subject to repeated stress, due to vibration or breathing actions. Such welds should possess toughness and ductility, without a uniform crystalline formation and these features can only be obtained by use of coated electrodes as described.

Electrodes for use with high carbon or manganese steel are also available. These metals cannot be passed through the arc, unless the electrode is specially treated, due to the high affinity of carbon and manganese for the oxygen in the air. These specially treated electrodes have been tried out with great success, and are particularly valuable in connection with work where such characteristics as a hard surface or resistance to abrasive wear is desired.

In order to obtain electrode material of a homogeneous structure and of accurate chemical proportions, special treatment in addition to the open hearth, or electric furnace process is necessary, to eliminate or reduce certain impurities which are detrimental in the iron when used for welding purposes, although entirely satisfactory when the wire is used in the construction of wire rope, fence, etc. These necessary processes increase the cost of wire for welding over that used for other work and it is self-evident that you cannot purchase practically pure iron wire, whose chemical composition is absolutely guaranteed to run even year in and year out, at the price for which ordinary fence wire can be purchased.

Large railroad systems who have had considerable experience in electric welding are beginning to realize the importance of selecting proper electrode material in order to obtain successful results and their findings are leading them to standardize on the best material possible to purchase, which will give a tough and ductile material in the weld. After all, it is not the welding wire you are paying for, but the form this metal takes when in the weld. Looking at it from this point of view, you will find high-grade electrodes much cheaper per pound than inferior wires, even though the initial purchase price might be two to three times as high. Would the person making the decision as to the grade of electrode purchased be willing to assume the responsibility of damage which is very likely to result from the use of a cheap electrode of inferior welding qualities, when superior electrodes, developed solely for electric arc welding purposes could be purchased at a slight increase?

The purchase of welding electrodes is a subject worthy of serious thought by every buyer of this class of material, and even though the cost of the electrode material used in a weld is insignificant compared to the complete cost of the job, still it is the factor which will determine whether or not you are going to have a lasting successful weld.

SCIENTIFIC MANAGEMENT AND LABOR

The *Bulletin of the Taylor Society* calls attention to the almost incomprehensible opposition on the part of the American Federation of Labor to scientific management. Doubtless this opposition is due to a misunderstanding of the aims and objects of this method of management. Organized labor, it seems, is inspired by fear that the differential rate system would impair one of the fundamental principles of the labor unions—the union rate.

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IN figuring the efficiency of any welding apparatus, there are four elements involved: 1, The kind of work produced. 2, The quantity of gases used. 3, The operator's time. 4, The apparatus and equipment.

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Fire Box Seams

THE eighth annual report of the chief inspector of the Bureau of Locomotive Inspection, which has been published contains uncomplimentary remarks about the growing practice of welding crown sheet seams. Because of a few violent explosions, which may or may not have been caused by poorly welded seams, the inspectors would prohibit the practice entirely. In his issue of February, the editor of The Boiler Maker says:

"The annual report of the chief of the Bureau of Locomotive Inspection points out several very important ways in which serious railroad accidents might be prevented. The greater number of casualties caused by the failure of the locomotive and its appurtenances may be charged directly to the rupture of some part of the boiler.

"Sections of the report and descriptions of some of the worst accidents due to boiler failures published in this issue of The Boiler Maker indicate just how vital the work of good construction and inspection are to the safety of the traveling public. By far the greatest cause for boiler explosions is low water, and, as the report points out, the faiure of welded seams in nearly every case contributed to the increased number of deaths from the accidents.

"The recommendations for limiting the use of autogenous welding in boilers, that have been made in connection with the report, certainly deserve consideration, if by the elimination of the practice a decrease in locomotive and other boiler disasters will result. However, welding has its field in boiler work and will continue to develop in spite of the accidents for which it is in part responsible, if various precautions are taken to insure the proper design of welded parts, the use of good materials and workmanship and an adequate check on all these factors by competent inspectors."

The hostility of boiler inspectors in several states would seem to indicate that certain interests in the boiler-making trade are gunning for the autogenous process. Inspectors do not seem to realize, or care to admit, that poor workmanship on the part of a boiler maker is just as apt to result seriously as poor workmanship on the part of a welder. Welders who are trained carefully and whose work is inspected thoroughly by competent inspectors who have the ability to recognize good and bad welding, are not apt to be the cause of serious accidents.

An Experimental Welding Laboratory

EVERYBODY agrees that the welding trade needs an experimental welding laboratory, an institution such as the French support, and which is used by them to advance the interests of the entire trade. Such a laboratory should employ the services of several men trained to their work, and their findings would become public property. Their work would be quite impartial and in no instance would they make comparisons of apparatus of any kind. Such a laboratory would be of the greatest service to not only the welding trade, but to all mechanical and engineering societies as well. *The Welding Engineer* would establish and equip such a laboratory were the expense not prohibitive. It would seem, however, that there are a sufficient number of progressive manufacturers and men in the industry to support such a movement. It might be started in a modest way, say at an expense of $20,000 to $30,000 the first year, and grow as its usefulness was demonstrated and its membership increased. Let us talk it over—here—in this column.

Train The Boys

NO boy should pass through a technical or trade school without acquiring some knowledge of autogenous welding. Upon leaving school and entering the ranks of the producer he should know when, why and possibly exactly how to apply an autogenous welding process. Nothing could be of more value to the young man than a working knowledge of our most efficient method of reclamation.

The Degree Of Welding Engineer

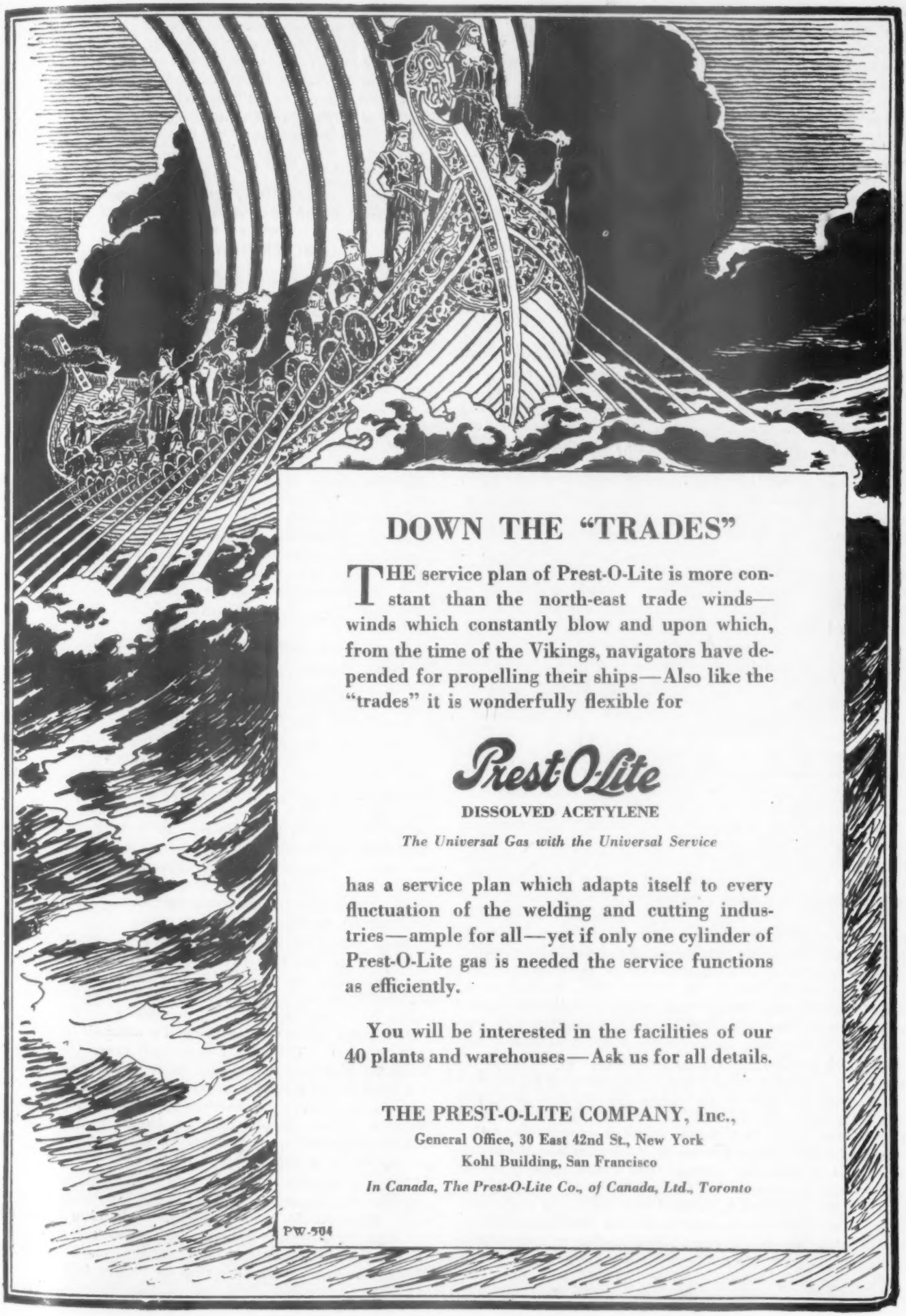
IT has been suggested that colleges and universities conferring mechanical and electrical degrees prepare to confer the degree of welding engineer (W. E.). To earn this degree the student would probably need certain parts of electrical and mechanical engineering courses, together with metallurgy, chemistry, gas engineering and possibly some other branches of engineering and mechanics. This suggestion is quite practical, one which any of the larger and better equipped schools are in a position to follow.

The German Welding Industry

A CAREFUL scrutiny of recent issues of Germany's leading welding publication gives one the impression that the welding industry has not made rapid progress during the war. The publication in question seems to enjoy the support of the entire manufacturing field, but the reading text would indicate a backwardness in the application of the process, and possibly also in the design and construction of apparatus. *The Welding Engineer* hopes to be able to present soon a complete digest of what has been done in Germany in the welding trade during the war.

Help The Welding Schools

AS we in the welding industry very well know, there is a scarcity of good welding schools. We have a few, but they are scattered and out of the reach of many young men who would take a course in welding if it were possible to do so. The remedy is more and better schools of welding. Many high schools, technical schools and universities would do more to train their students in the art of autogenous welding were it possible to secure the necessary equipment and supplies. It would seem that the trade could serve its own purposes very well by doing everything possible to assist and encourage schools and colleges desiring to teach autogenous



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welding. In every locality friends of welding might influence local educators and public-spirited citizens to help the local schools establish good welding courses. This work would also be a fine outlet for the energy and money of a welding society.

Answer The Ads

READERS of trade magazines may be sure that manufacturers advertise in trade magazines for only one reason—it pays. And it also pays the subscriber. The more advertising in the trade magazine the better magazine the editor is able to give you. Therefore, when writing or talking to advertisers it pays to mention the paper in which you saw the advertisement. No reader can afford to pass lightly over the manufacturers' announcements. They contain valuable information and much news.

WHAT SHALL I CHARGE?

Editor:

I operate a garage and machine shop here in a good small average South Dakota country town. Naturally I do oxy-acetylene welding. I am enjoying a nice business and do considerable very successful welding, including quite heavy welding for a small country town. I am making money out of it, but I make my money out of the big jobs. I get quite a number of jobs every year where I get from $25 up to $75 for a single job, such as gear welding on tractors and boiler work. I also have any amount of small jobs amounting to $5 and $10 a piece and I do some jobs for as little as 25 cents. I turn no small jobs away, even if I loose money on them, thinking that perhaps they may bring a big one around. Now what I am getting at is this. I read your article in the January issue "What Shall I Charge?" and your comment in the February number on the same subject prompted me to write this letter.

To start with, I might say I have no set or cost-plus price in my business of welding. It is a fact that there are many good welders through this part of the country that are not charging enough for their work. This welding business requires considerable of an outlay to start with and besides that, it costs money to carry it on. In my estimation, the welding business is akin or parallel to a manufacturing business in its scope of usefulness. Castings and parts of machinery can be successfully retained by it that could not be replaced successfully except by a manufactured new part.

I find that pretty much all the way through the commercial world the item that regulates price is competition. Where there is no competition or a combine, the price is generally arrived at by figuring cost-plus and a good big profit. The welding business is hard work and to be good requires considerable experience and it has more or less unavoidable grief connected with it all the time. Therefore, I see no reason why the welding business is not entitled to a good profit so long as it is giving 100 cents for the dollar in value.

The plan which I try to follow out is this: As long as my only competition is new parts, I try to keep posted as near as possible on the cost of new parts for machinery in general. So, if a casting comes in on which considerable machine work has been done, I naturally charge more than I would for a plain rough casting of like size. My plan is to charge from one-half to two-thirds the price of new parts unless the price of the part is way up. If I go out and weld a small projection on a casting in place on a tractor and it would take from $15 to $20 worth of labor to take the engine down and replace the casting, then under conditions like these, I see no reason why it is not legitimate and perfectly all right that I should be entitled to a good, big profit, providing I am fortunate enough to get the job, do a first-class repair and save the owner of the machinery considerable money at the same time.

I might mention welding car frames, of which I do considerable. A broken frame comes in; it will cost anywhere from $10 to $25 to repair the frame any other way except welding or replacing with a new frame. My conscience does not bother me a bit if I charge the owner $10 for the job and do good work, even if it does only take from 35 to 40 minutes, and I think the owner will remember the quality long after the price is forgotten. It would indeed be interesting reading if we could hear from some more members of the trade on the subject.

Bert E. Smith.

Note: The two old timers who started all of this seem to have writer's cramp.—L. B. M.

SCIENTIFIC WELDING

In discussing the work of the French Welding Society and the results achieved, and the need of such an organization in the United States, a prominent manufacturer of apparatus makes the following statement:

"The question of the right kind of welding materials (rods, wire, fluxes, deoxiding agents, etc.) is, in my opinion, one of the fundamentals of the welding industry. It is also the one which, in this country, has received perhaps the least consideration of anything pertaining to our industry. Some manufacturers of welding rods and wire have certainly made creditable efforts to produce soft steel wire which is very much better than wire which was produced five years ago.

"But unfortunately for the welding industry, at least two important factors have delayed the development of some classes of, what might be termed, first-class welding materials. One is the lack of scientific and impartial research work; the other that large quantities of welding materials have during the past years been bought and sold in a buyer's market.

"The research work along this line done by the Union de la Soudure Autogene has been of the greatest value to the French welding industry. While we have profited to some extent by their efforts we do not know all that we would like to know about the results of their work and consequently we, and I use the word we collectively, are accepting certain information which may or may not be vitally important, either because the information is ambiguous or that some facts are known and others not. As an example I will mention that textbooks on welding, printed in French, English and German, are at great variance as to the exact amount of phosphorus which should be present in copper welding rods and wire. Most of the research work was done by the French laboratory and the results accepted and misunderstood by the others. The variations as stated in the books are from 0.5 to 0.05 to 0.005 per cent.

"Some manufacturers of steel have specialized on steel welding wire. But how have they arrived at the conclusion that their particular product is best suited for the purpose intended? So far as I know, by producing a product as nearly free from impurities as practically possible, and by accepting the statements as to results obtained by the users of the products. This is well so far as it goes. Do you know definitely, however, that purity alone determines the value of a material for a certain purpose? Or, to put it in another way, do we know for sure that pure iron (within possible limits) is the best suited for steel welding? Is it not possible that the introduction of what otherwise might be considered an impurity may prove beneficial?

"While it may be true that, when a welded job meets the practical requirement, it is in a sense satisfactory, a good many failures could, no doubt, be avoided and more uniform and dependable results obtained, if the fundamental knowledge of the requirements were better known and understood, which leads to the conclusion that we neither definitely know

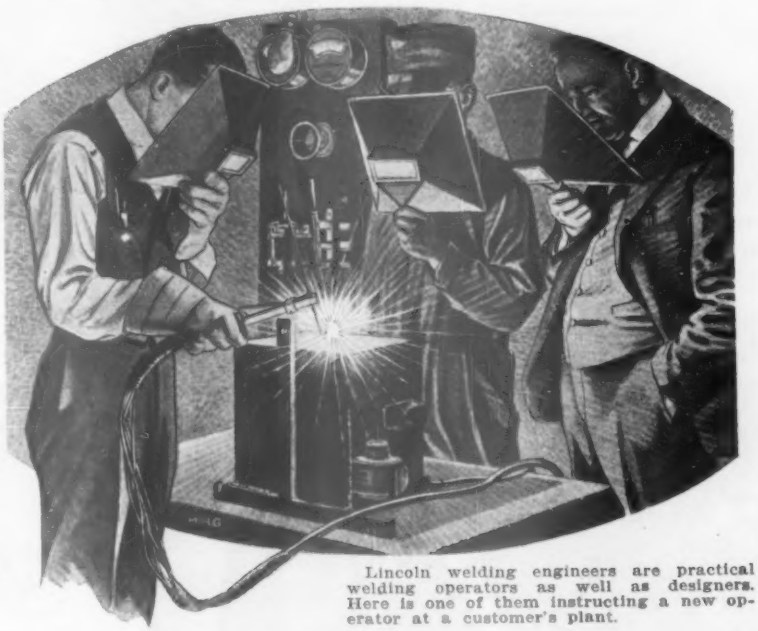
LINCOLN ARC WELDER

Designed by Practical Welding Operators

The men who designed the Lincoln Arc Welder knew *welding* as well as welders.

They knew that the Lincoln equipment must be easily operated and simple—and they made every last detail rugged, simple and strong enough to stand the hard everyday work of welding shop service.

They knew the necessity of a steady arc—so they made a generator which adjusts itself instantly to every variation of resistance and work surface.



Lincoln welding engineers are practical welding operators as well as designers. Here is one of them instructing a new operator at a customer's plant.

They knew that maximum welding speed can only be attained when the operator can concentrate all his attention on *welding*—and they made the Lincoln Arc Welder control the arc-length and heat *automatically* so that he doesn't have to worry about them.

They knew that the usual ballast resistances used to steady the arc were wasteful—so they eliminated them. The result—40% to 80% saving in running costs; a simple, practical outfit; and 20% greater all-day output than any other welding machine made.

Write for Bulletin 104-W—it will tell you the "why" and "how" of the Lincoln Arc Welder.

This Standard Lincoln Motor has operated under water for over 3 years without damage.

THE LINCOLN ELECTRIC CO.

General Offices and Factory, Cleveland, O.

Chicago.
Detroit.
Columbus.
Pittsburgh.
Minneapolis.
Philadelphia
Charlotte, N. C.
Cincinnati
Hartford, Conn.

The Lincoln Electric Co., of Canada, Ltd., Toronto-Montreal

Agencies in other principal cities

the factors involved nor the solution based on factors which may be known.

"One great trouble with welding materials in general has been that the quality has not been uniform. Some shipments have proven very satisfactory, while other materials have been worthless.

"Another phase of the question of the right choice of welding material is, of course, the known or unknown properties of the material which is to be welded.

"It appears to me to be more important to find out first the desirable properties of welding materials than to try to determine the best welding results obtainable with one particular brand of steel wire, which may or may not be the best for welding of soft steel plate of known physical and chemical properties.

"Most manufacturers of steel have been so extremely busy producing steel for other purposes that they have had very little interest in the production of welding wire, and the consumers have, therefore, had to accept anything possible to obtain, that would produce at least fair results.

"A better understanding of what constitutes good welding materials is not only desirable, it is essential.

"I wish to state that my remarks have reference to oxy-acetylene welding."

WELDING FOR THE ORIENT

The accompanying illustration of a welding operation is interesting, not so much because of the nature of the job itself, but rather because the ultimate use of the material being welded illustrates the part America and oxy-acetylene

Welding for the Orient.

welding are playing in the industrial awakening of China.

The ring forms the top section of a 100-foot smoke stack. This stack is now being fabricated in a Pennsylvania shop from whence it will be sent in sections to China and used in the construction of a textile mill in Tientsin.

TENSILE TESTS ON ELECTRICALLY WELDED STAYBOLT PARTS*

The following tensile tests on welded staybolts are instructive because of the very little laboratory work that has been done in this connection. Oftentimes the value of such organization to increasing production. As a matter of fact, work is neglected in the attempt to devote the energy of an production and the quality of material produced may be greatly benefited in any industry by the intelligent use of a well-equipped laboratory. If the limiting qualities of material are known, the maximum efficiencies may be utilized to the best advantage.

Series No. 1—⅜-inch by 4-inch Plate with 1-inch 12V Thread Tapped Hole.

	Ultimate Strength Pounds
A—With open hole	75,700
B—With 1-inch bolt—head riveted	73,200
C—With 1-inch bolt—head welded	79,800

Riveting reduces the plate strength by 3.3 per cent.
Welding increases the plate strength by 5.4 per cent.

Series No. 2—¾-inch by 4-inch Plate

	Ultimate Strength Pounds
D—With hole tapped 1⅛ inches, 12V thread (¾-inch taper), standard sleeve (style F) applied	109,300
E—Recessed for bolt and welded cap (cap not applied)	120,200
F—Recessed as in Test E, but with cap applied	146,300
G—With U sleeve applied	135,800

Preparation for bolt and welded cap leaves the plate 10.0 per cent stronger than when the plate is prepared for and equipped with the standard sleeve.

Plate recessed and reinforced by the welded cap is 33.8 per cent stronger than the plate prepared for and equipped with the standard sleeve.

Plate recessed and reinforced by U sleeve is 24.2 per cent stronger than the plate prepared for and equipped with the standard sleeve.

Series No. 3—⅜-inch by 4-inch Plate with 1⅛-inch 12V Thread Tapped Hole.

	Ultimate Strength Pounds
H—With 1⅛-inch button head bolt	72,100
I—With 1⅛-inch welded head bolt	82,000

Welding the head increases plate strength by 13.7 per cent.

*Tests conducted by the Flannery Bolt Co., Pittsburgh.

FURNACE GRATES

Editor:

The February number is sure a good one. There is a good lot of common sense to the subjects. Mr. Campbell's is a fine paper and is very interesting indeed. The one by Brother Totten on pressure welding is something to think about, especially in boiler welding. I have visited several railroad shops and I have found that every craft has or does its own welding, instead of having a welders' union. You would not think of seeing a machinist doing boiler work or a blacksmith doing machinist or boiler work. So let us get busy and have a welders' union and I think we will have better welding done. I believe in more schools for welders. Get them started right and they will be right. There are too many would be welders who buy equipment and hang out their shingles and profess to be experts. I think that is a bad blow for the craft. When a good welder hangs out his shingle and does good work, some people who have had inferior welding done are skeptical and it is a hard matter to convince a customer. Mr. S. L. West said he would like to hear from a welder who welds his cast iron by the cold process. Well, I am from the same state, show me.

R. H. Anderson,
Brookings,
S. D.

Welding Tanks with Alternating Current

ELECTRIC WELDERS

This oil storage tank, after being in service, leaked at seams and rivets so as to be absolutely useless. An A. C. Welding Machine was used to weld seams and around all rivets. No pinholes or weeps were detected after welding.

An interesting feature was the raising and turning of the tank by pouring water into the pit in which it was buried. Some of the holes were welded under water to stop tank from sinking until careful work could be accomplished.

It Also Has Other Desirable Features:

It has high efficiency
It uses any type of electrode
It has no maintenance cost
It has a low first cost
It uses less power
It has greater penetration than other machines
It is 20% faster than other machines

Which Feature Interests You?

Our Catalogue No. 104 will reveal surprising facts on Welding

ELECTRIC ARC CUTTING & WELDING CO.

222 Halsey Street **Newark, N. J.**

AN ADVERTISING CAMPAIGN *for* JOB WELDING SHOPS

By PAUL KEESE

HOW to make welding better known! How to make welding believe in—*trusted!* How to make understood the miracles of reclamation! Of waste saving! Time saving! Cash saving! How to "tell the world" that often a weld costs only 5 per cent of a new part's cost—that 50 per cent is usually *the very least* a weld can save! This campaign does these things.

How to make More people use More welding! How to make *your* welding the work these people want! How to put yourself BIG on your local map! These are your toughest problems. And this campaign SOLVES them for you.

The welder with the small advertising appropriation can now for the first time command that highest type of merchandising and advertising counsel, advice and service obtainable heretofore only by the heaviest investors in big national publicity.

Backed by the Endorsement of "The Welding Engineer"

For some months past we have had, among the things we hoped soon to find time to do, the idea of developing a definite and complete plan to assist the job welder increase his business by advertising. We have sent out much correspondence and have stirred up an enthusiasm which showed we were on the right track, and that welders all over the country are hungry for this assitance.

With our budding scheme almost ready to flower, along came, about two months ago, an organization with a complete campaign all worked out, finished and complete, the ideal, perfect handling as we had partly planned it. The Knapp Co., Inc., of New York City, foremost direct-by-mail advertising concern of America, had beat us to it—and hit the mail right squarely on the head.

Certain Large Results—For Small Investment

The Knapp-Advertised welder can put his proposition squarely up to all he cares to reach: machine shops, forging plants, foundries, textile mills, paper mills, steam and electric railways, mines, shipyards, garages, auto owners—anybody. He can grow!

KNAPP-ADVERTISED, the welder gets his rightful chance at jobs he never could get before—to mend breaks, build up worn parts, repair flaws. All good as new! He saves his trade so much in costs he gets boasted about. He walks on the Road to Fortune that leads from the Town of Fame.

Reproduced by photograph above are five of the twelve in the series of Knapp mailing pieces as used (mailed monthly) by The Dayton Welding Co. of Ohio.

These striking novel folders fulfill *every single requirement* that professional experts recognize as essential to success in advertising.

First, becoming, impressive *dignity*. Second, the *"color-spot"* that grips attention: charming, mounted art prints in eight colors—the work of famous painters—your choice of hundreds of subjects of every kind. Fine, real art that inspires the desire

"I Never Thought Such A Saving Was Possible"
Increase the Power of Your Welding Dollars
We Give You the Results You Want
Analyze These Money-Saving Facts
Our Guarantee Is Your Protection
Quality Work By Expert Workmen
Seeing Is Believing—Judge for Yourself
Expert Supervision Of Expert Work
THE DAYTON WELDING CO.
DAYTON, OHIO

Folders Turned Up, Open. The advertising is bold, clear, easy to read and understand.

Superior Brazing Compound

A product of years of time and study. Over 98 per cent pure boron. Its use is not attended by deposit or scale. Acts as a superior flux and purifies the brazing spelter, causing spelter to flow evenly into every part of joint, without deposit, scale or enamel. A trial will convince the experienced welder of the merits of Superior Brazing Compound.

If your dealer cannot supply you, we will.

Standard Mfg. Co.
318 S. Canal St., Chicago

Cheaper than any other compressed gas

GASOL

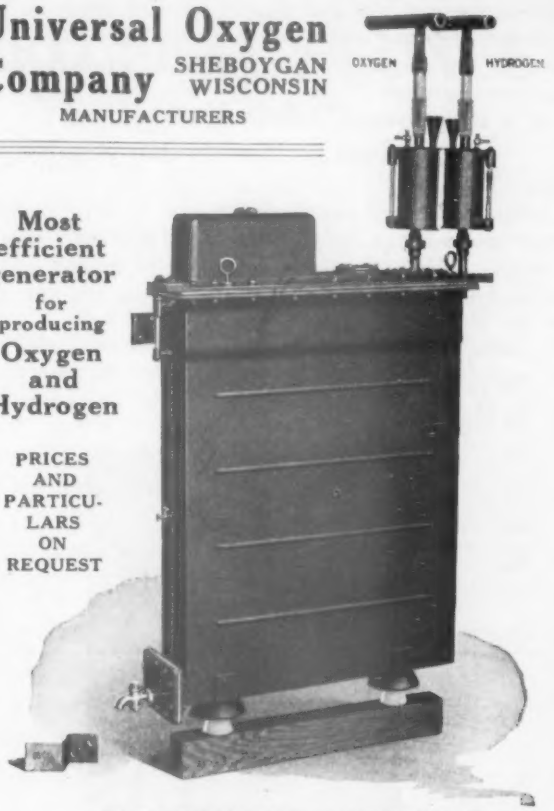
For
Pre-Heating
Brazing
Cutting
Welding
Cast Iron

Rockgas Product Company

Standard Life Bldg., PITTSBURGH, PA.

Universal Oxygen Company

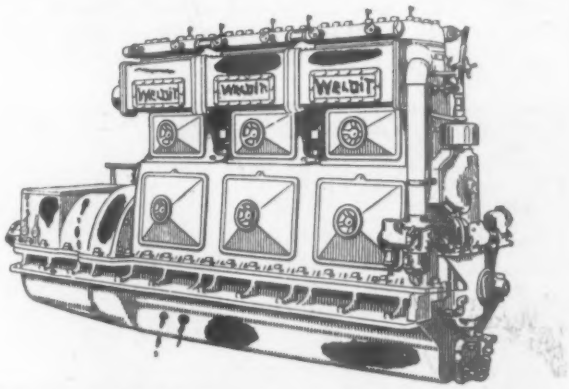
SHEBOYGAN WISCONSIN
MANUFACTURERS



Most efficient generator for producing Oxygen and Hydrogen

PRICES AND PARTICULARS ON REQUEST

ELECTROLYTIC OXYGEN & HYDROGEN CELL MODEL C



Weldit Metal Mender

Stops All Leaks

Finishes all welds as smooth as glass, the same shade and appearance as cast iron; splendid for any metal.

A great many welds are rough and pitted. Simply heat weld or leak up to a good warm heat and our WELDIT Metal Mender will melt on the warm metal and as soon as cool the mender will harden to a very hard, exceedingly tight, sticking film that is water and acid tight. Your work then leaves your place finely finished, smooth and clean, with no leaks.

No experience needed—simply heat and melt on.

Supplied in sticks about ½-inch diameter by 6-inch long; used by scores of foundries for patching bad spots in castings, and by welders for stopping leaks and finishing up poor looking welds. Any kind of heat that will warm the metal is all that is necessary.

As important to a welder or foundryman as his telephone.

Black marks on above sketch will give an idea of how it is used.

Price $5.00 per pound—runs from 10 to 11 sticks to the pound.

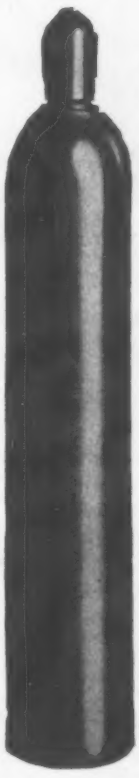
One of the most valuable inventions since the introduction of welding.

SPECIALISTS IN HIGHEST GRADE WELDING EQUIPMENT AT HONEST PRICES.

WELDIT ACETYLENE CO.
68 Grand River Avenue, West, Detroit, Mich.

Manufacturers of

SEAMLESS STEEL CYLINDERS



For:

Oxygen
Hydrogen
Blaugas
Butane

Interstate Commerce Commission Specifications

RIGHT PRICES—PROMPT DELIVERIES—SUPERIOR SERVICE

Wm. Wharton Jr. & Co., Inc.

[Founded 1859]

Gas Cylinder General Sales Offices:
30 Church St., New York City

DISTRICT OFFICES:

Boston, New York, Scranton, Chicago, Philadelphia, San Francisco, Pittsburgh, Cleveland

to keep. Third, utility, timeliness—the calendar feature that suggests frequent use and insures repeated attention. Fourth, illustrated message copy, elaborated in one or two colors by powerful pen sketches and photographs of actual feats of welding, including views of jobs "before and after" work is done,—*all of it* instinctively, fundamentally RIGHT!

Welding Publicity That Compels Attention

Here is advertising that busy men take time to read. Guided by Knapp advertising experts, you get the sort of publicity that makes your message *force* a reading and persuades your reader to ACT. Back of every mailing piece is brains, energy and accumulated experience in the art of writing and presenting in type and picture the kind of advertising that pulls.

At work for you, once you have adopted this publicity plan, will be the value-giving power and will of the chief organization of its kind. Yet, because the cost of maintaining its expert staff is distributed over a tremendous patronage (which includes many of the largest American and foreign advertisers in all lines of business) your investment is surprisingly *low*.

Folders Are Shown Closed, Ready for Hanging on Wall, with welder's business card and monthly calendars in full view. See punch hole for pin or tack.

Furthermore, publicity of this kind, as has been proven repeatedly, pays for itself as it goes along. Every dollar is *real investment*. Every penny brings dependable *cash return*—prestige—profit.

How to Take Advantage of This Campaign

A letter to *The Welding Engineer* offices, or direct to Promotion Department, The Knapp Company, Inc., 4th Avenue at 19th Street, New York, N. Y., will bring you full details. There are Knapp representatives throughout the United States and Canada. You will be corresponded with direct by mail, or one of these representatives will call upon you.

With metal prices soaring almost to war-time heights, the wise welder will get on the band wagon NOW, where his usefulness is more valuable, and his chances for big business larger, than may ever happen again.

SUCCESSFUL STUDENTS

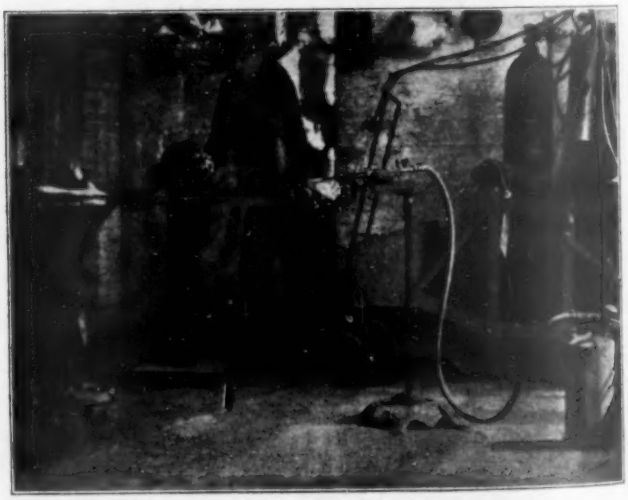
Two former students of the Davis-Bournonville Welding Institute, are operating a successful welding business at Auburn, N. Y. The firm of Bell & Pound have facilities for the handling of the largest castings and make the larger work their specialty. The illustration shows their general

line of work. It is a pleasure to run across former welding students who have put knowledge thus gained to such good use and who, in a brief time, are equipped to handle difficult and unusual work. Such welding shops are not only an asset to a community, but help the welding trade at large.

GEAR CASE

Editor:

I am sending you a picture of a differential gear case that I welded. This case was broken so badly that other welders refused to weld it. It was sent to our shop to see what we could do with it. It was broken in half and all out of shape



and it also had some pieces broken off. This case belonged to one of our business men in Columbia. He was down at Washington, D. C., when it broke down and after it was welded it was sent back to Washington and put on the car again as it is as good as ever. The garage men at Washington said to him that it was the best job of that kind that they had ever seen. If you care to publish this picture in The Welding Engineer, you can. I welded it with tobin bronze. This job was done about six months ago and the owner told me the other day that it is as good as ever.

H. B. Bartch.

IMPERIAL
WELDING CUTTING EQUIPMENT

You can't afford to use less than the best facilities in your repair work. Imperial Welding and Cutting Equipment is first in Safety, Speed, Economy and Efficiency. Its maintenance cost is low because of the small gas consumption, and a single operation often pays for its cost.

We are headquarters for Welding, Cutting, Carbon Burning and Lead Burning Equipment and Supplies of all kinds and ship on short notice. Write for the Imperial Catalog and full, detailed information regarding methods of operation, economies effected, etc.

IMPERIAL BRASS MFG. CO.

522 S. Racine Avenue CHICAGO, ILL.

Large rope drive pulley broken in seven pieces. Welded with Imperial Equipment.

RED SEAL FLUXES

The Best is the Cheapest

We offer the same FLUX that we have been using in our own shop, which is the largest in the SOUTH, for eight years. RED SEAL FLUXES are the best that can be bought at any price and at much lower prices than many inferior brands.

RED SEAL CAST IRON FLUX	Per lb.
1 to 5 lbs.	$0.50
5 to 10 lbs.	.45
10 to 25 lbs.	.42
25 to 50 lbs.	.40
50 to 100 lbs.	.37
100 lbs. or over	.35

Prices on FLUXES for other metals furnished upon application.

Cast Iron Rods, Welding Wire for Steel, Aluminum Rods, Tobin Bronze.

Write for Jobber's prices.

Memphis Welding Co.
MEMPHIS, TENN.

WELDING PINCER
MODEL 3
Price, $1.00—3 for $2.50

Length, 16 inches. Weight, ½ pound. Holds the welding rod rigid at angle shown.

U. S. A. Patent No. 1301185, April 22nd, 1919, Foreign Patents Pending.

A slight pressure on small lever opens jaws.

SENT TO ANY WELDING SHOP FOR A 30 DAYS' TRIAL ON RECEIPT OF PRICE.
If not needed after that, return pincers and money will be refunded promptly.

Jobbers and Agents, write **C. SORENSEN, 18 E. 16th St., CHICAGO**

Campbell's "Oxy-Acetylene" Welding Manual

By Lieutenant Lorn Campbell, Jr.
Ordnance Corps, U. S. A.

Lieut. Campbell organized and conducted the Army Welding School at Peoria, Ill. His new manual is based on his experience there, in training soldier welders. 154 pages, 89 illustrations, bound in cloth, $1.25.

THE WELDING ENGINEER
Chicago, Ill.
608 S. Dearborn St.,

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Part Four—Welding of Cast Iron.
VII. Part One — Steel Welding.
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BLOWPIPE MANIPULATION

*A New Method of Executing Welds**

Position of Blowpipe.—The flame of the blowpipe should be given a definite inclination. In certain cases and especially with expert welders, familiar with the new method of executing welds, this inclination of the flame to the plane of the weld is very large, in other words, the flame is almost perpendicular to the weld. We have, however, made a series of experiments to discover the best angle and have found that an angle of 20 degrees gives the best results, that is to say, the angle between the nozzle of the blowpipe and the perpendicular should be 20 degrees, the flame being turned backwards as shown in Fig. 6. Beginners should pay particular attention to obtaining and practically working at this angle of inclination.

We have previously stated that in welding backwards it is the welding rod that is given a movement and not the blowpipe. The blowpipe is therefore held in such a manner that the flame advances along the bevelled faces with as great a regularity as possible, the rate of movement being in proportion to the speed of welding. A very slight transversal

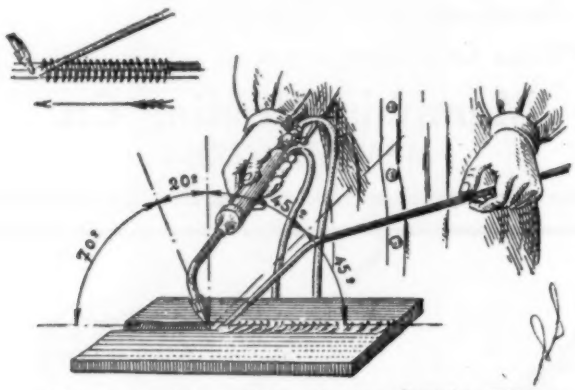

Fig. 6.—Position of Blowpipe and Welding Wire.

movement may be given to the blowpipe to produce more rapid fusion of the two bevelled faces.

A series of welds have been made by this new method with a blowpipe fitted to the loose headstock of a lathe, the advancing movement being thus mechanical. In spite of the absence of the slight transversal motion we are convinced that this basis of construction can be adopted for welding machines constructed for welding backwards.

However, it is interesting to note that the hand of a welder holding a blowpipe, even without movement other than that of advancement, seems to be much preferable to a machine because, without giving precisely the lateral movements to the flame, the hand can constantly direct the welding part of the flame to the requirements and thus advance or retard the movements in such a way that the bevelled faces are attacked properly and the weld is being executed in conjunction with the proper handling of the welding rod.

Position of the Flame.—The white cone of the flame should penetrate very deeply into the angle of the V as shown in Fig 7. If held too high as shown in Fig. 8 the melting at the bottom of the V is not sufficient, the size of the weld is unnecessarily increased, the metal near the surface is overheated and the speed of welding is diminished.

The penetration of the white cone should be carefully observed if the advantages, economy and quality of welds, which can be obtained by welding backwards are required.

Position of the Welding Wire.—The melting of the metal is produced, as previously explained, behind the blowpipe and not in front as is the common practice.

This melting is no longer obtained by the welding cone of the flame, but by the additional heat contributed by the envelope of the flame, the blowpipe being inclined towards the rear, in other words, towards the welding wire, as shown in Fig. 6.

The position of the welding wire and its movement should be closely followed. The wire is inclined to the line of welding, in the advancing direction, that is to say, in the opposite direction to the inclination of the flame. The best angle of inclination, between the weld and the wire has been found to be 45 degrees for material about ¼-inch thick, and for thinner material, say ⅛-inch, an angle of about 30 degrees.

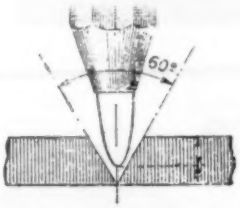

Fig. 7.—Position of the Flame.

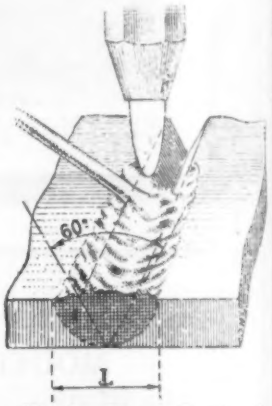

Fig. 8.—Wrong Position of the Flame.

This inclination is maintained whilst the welding wire is given its proper movement in the line of welding. This movement for the thicker material, say, about ¼-inch, consists in alternately moving the molten extremity of the wire from one side to the other of the line of welding, as shown in the small illustration in Fig. 6. The movement for material less than this thickness becomes first of all ellipsoidal or gyratory, and then for material about ⅛-inch, and especially when the material is about 1/16-inch, the movement is translated into a reciprocating one without any transversal movements, as shown in Fig. 9. In both these cases the extremity of the wire remains continually in the molten bath.

Execution of Welds.—In order that the line of welding should present an homogeneous appearance, it is advisable to operate in the manner already laid down and with the same speed at the commencement and completion of the execution. If, say, one of the extremities of the weld is attacked too soon with the blowpipe, free fusion and regular advancement are not obtained until after a certain time, with the result that irregularities are noticeable at the beginning of the weld. To avoid this the plates should be preheated for a length of a few inches with the blowpipe, so as to obtain, at the beginning, regularity, and a normal rate of welding. The blowpipe and the welding wire being held in the manner

(Continued on Page 56)

* By Capt. D. Richardson in Acetylene & Welding Journal, London. An installment of this article was published in The Welding Engineer for February, 1920.

SCORED CYLINDERS

and cracked water jackets successfully repaired. Our factory nearest you will make these repairs on a 24-hour service basis.

Regrinding of cylinders that have been scored by wrist pins or through other causes is unnecessary. The Lawrence Patent Process fuses a silver-nickel alloy into the defects making a quick, clean, permanent job **without altering the bore of the cylinder.** Same piston and rings fit.

Cracked Water Jackets are Also Made Permanently Good through this Same Process.

A list of our factories and licensees is given below. There is one near you. Send your scored cylinders and cracked water jackets to the nearest plant. There we will insure you quick service and perfect results. Aside from the liberal arrangements we make with you, the money saving service you render your customers will help make you known as a concern that looks after their interests—and this is a business asset in itself.

We guarantee all of our work. Write to any of our plants for full information.

PLANTS

Buffalo—10 Summer St.
Chicago—1522 Michigan Ave.
Cleveland—6529 Euclid Ave.
Detroit—85 Meldrum Ave.
Los Angeles—1030 S. Grand Ave.
Milwaukee—18 Martin St.
Minneapolis—14 N. 9th Street.
Newark—292 Halsey Street.
New York City—355 W. 57th St.
Philadelphia—1601 Summer St.
Pittsburgh—5102 Baum Blvd.
San Francisco—116 Hyde St.

LICENSEES

Akron, Ohio—Akron Welding Co.
Montrose, Colo.—Hartman Brothers.
Bridgeport, Conn.—United Welding & Repair Co., 172 Elm St.
Cincinnati, Ohio—Cincinnati Welding Co., 410 Richmond St.
Columbus, Ohio—Central Ohio Welding Co., 200 East Lynn St.
Denver, Colo.—Blanchette Welding Co., 149 South Broadway.
Erie, Pa.—Lake Erie Welding & Spring Co., 338 W. 12th St.
Grand Rapids, Mich.—Ox-Welding Company.
Harrisburg, Pa.—Harrisburg Welding & Brazing Co., 94 South Cameron St.
Boston, Mass.—David H. Miller, 6 St. Mary St.
Kansas City, Mo.—General Auto Parts Co., 1621 Grand Ave.
Lima, Ohio—Buckeye Welding & Repair Shop, 133 Water St.
Memphis, Tenn.—J. B. Cook Auto & Machine Co., 294 Washington Ave.
New Haven, Conn.—New Haven Welding Co., 763 State St.
Portland, Me.—Portland Garage Co., 49 Cross St.
Providence, R. I.—Rhode Island Score Filling Co., 173 Eddy St.
Richmond, Va.—F. D. Schluter Auto & Welding Co., 1009 W. Broad St.
St. Louis, Mo.—Scored Cylinder Repair Works, 325 N. Jefferson Ave.
Schenectady, N. Y.—Franken Oxy-Acetylene Welding Co., 5 Villa Road.
Springfield, Mass.—Hoag Welding Co., 31 E. Court St.
Troy, N. Y.—Reliable Auto Repair Shop, 229 River St.
Washington, D. C.—Day Welding Co., 43 Sumner Court, N. W.
Worcester, Mass.—Central Autogenous Welding Mfg. Co., 98 Union St.
Youngstown, Ohio—C. F. Erb, 722 Madison Ave.
Montreal, Canada—Pyke Motor & Yacht Co., 374 Notre Dame St.
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Toronto, Canada—Ontario Motor Car Co., Ltd., 18 Bloor St., East.
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Melbourne, Australia—Finlay Bros., 322 Elizabeth St.
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Wilmington, Del.—J. A. Dillman, 308 Madison St.
Salt Lake City, Utah—Karl Winter, 719 S. State St.
Pensacola, Fla.—East Hill Garage, 1501 E. Blunnt St.
Springfield, Ill.—Romie Fields, rear 317 S. 3rd St.
Rochester, N. Y.—General Welding Works, 87 Cortland St.
Galesburg, Ill.—Galesburg Machine Works.
Eustis, Fla.—M. Hopson.
Cedar Rapids, Iowa—Otto J. Jirsa, 1328 L St.
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Utica, N. Y.—Sherman Sales Co., Inc., 516 John St.
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Savannah, Ga.—Henry W. Smith, 421 Bay St.
Birmingham, Ala.—W. T. Sanborn & Co., 1010 N. 19th St.
Dallas, Texas—Lawrence Process Co., 511 Main St.
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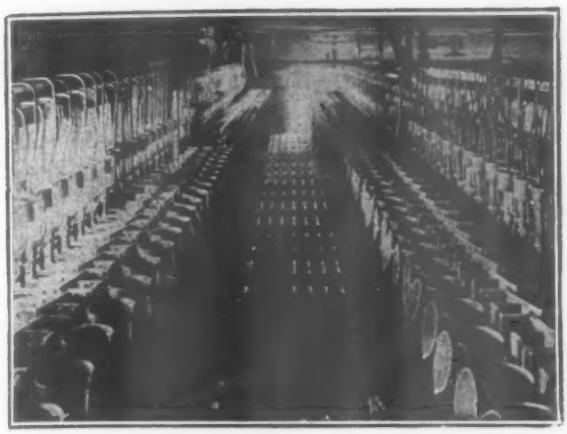
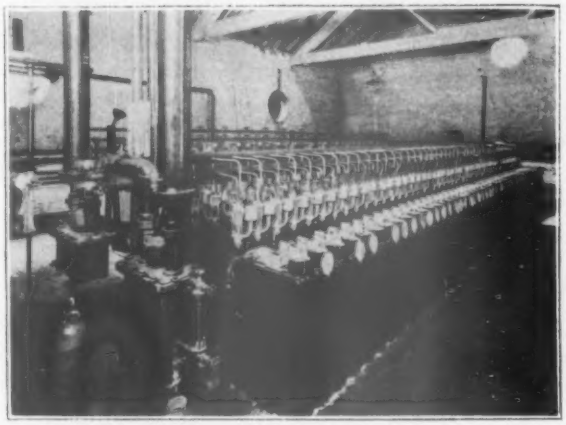


Levin Cells at General Electric Co., Erie, Pa. First installation in foreground, second installation in rear. A Third installation of 100 recently purchased makes a total of 300 Levin Cells.



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Under the Technical Supervision of Electrolytic Oxy-Hydrogen Laboratories, Inc.

(Continued from Page 52)

indicated, the cone of the flame is directed so as to well penetrate into the angle of the bevel, and the first molten bath is obtained by giving the blowpipe a slight gyratory movement, immediately after which the extremity of the welding wire is introduced into the molten bath and the blowpipe is then given its regular advancing movement.

The welding wire, on the other hand, follows immediately after the flame, and describes a reciprocating or a more or less elliptical and longitudinal motion, according to the thickness of the metal, as indicated and shown in Figs. 6 and 9, taking care to always maintain the given angle of inclination. The weld is thus obtained in a normal and very continuous manner. Care must be taken to use a welding wire which satisfactorily fills the lines of welding, without excess or insufficient addition of material. If necessary, the position of

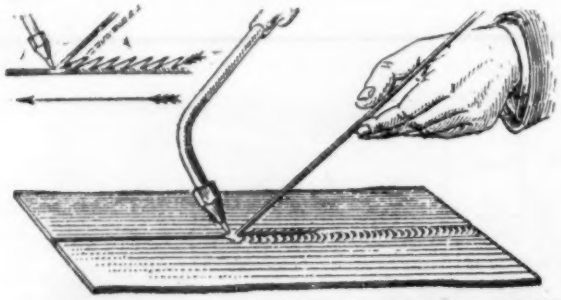

Fig. 9.—Movement of welding wire for thin material.

the blowpipe is changed when the extremity of the weld is reached in order to obtain a clean finish as is usual with the ordinary method of welding.

The melted metal being attacked in the rear, as a result of the inclination of the flame, the bevelled faces are always well melted; the weld is what is commonly said to be well penetrated and the defect of adhesion is almost impossible. However, it is advisable not to travel too fast so as to give the bevelled surface sufficient time to melt freely, otherwise candles of molten metal will appear on the underside of the weld as a result of the addition of too much heat at the bottom of the V.

SALT LAKE WELDING SCHOOL

The Salt Lake Technical High School is operating a welding school, the instructor in charge being Mr. Ernest F. Voelker. The course is approximately from four to six months long, day and evening classes being held. No fee is charged for the day course and $1.25 per month for the night course. Each class receives about one and one-half hours of welding.

RULES ON BOILER WELDING†

By B. K. Smith*

In reading the new rules adapted by the Committee on Standards for the purpose of preventing the use of oxy-acetylene welding for purposes for which it is not well adapted, the author has seen no new prohibition in boiler welding, nor in the way it was created.

Rules Numbers 1, 2 and 3 were followed for years by all responsible boiler welders.

Rule No. 4 was also followed by boiler shop foremen, with the exception of repair work, where new side sheets, fire sheets or door sheets were welded to crown sheets at any convenient line below the crown. However, reading the second paragraph of rule No. 4 where it says: "This is not intended to prevent welding the crown sheet to other fire box sheets," should settle the disputed question to responsible boiler welders of welding fire box sheets to crown sheets.

The rulings of Nos. 5, 6, 7, 8 and 9 were also strictly observed years ago by well-known boiler welders. The only exception the author takes is to rule No. 4, third paragraph, where it says: "Side sheet seams shall not be less than 12 inches below the highest point of the crown." It means to say that if a poor weld was made 12 inches below the highest point of the crown it would not be as dangerous as it would be if made above the 12 inch line. The author does not agree with this statement, because if a weld is good, it will stay good regardless of whether the weld is made 8 or 10 inches below the crown, and if the weld is not good, it will do just as much harm whether it is made 8, 10, or 12 and 14 inches below the crown.

The author and many others connected with the welding trade and who are also familiar with railroad shop conditions, are rather inclined to believe that all these supposedly new rulings are the result of an attempt to cover up unexplained accidents on boilers, which happened to be welded. However, it is sufficient for the boiler foreman, inspector or general formean, to get a temporary excitement or scare, or misuse these rulings as excuses for failures on fire boxes which are welded. Some of our railroad officials went even further and discontinued or discouraged welding in their shops on the strength of these new rulings.

Of course, in such cases, these officials must return to the old methods of patch bolts or riveting. This reminds us of that old physician who advised a patient suffering with appendicitis to quit eating. Now, our more advanced physicians, in order to obtain a more permanent remedy, will cut out the appendix and thus relieve the patient's sufferings.

In applying the same course with boiler welding the author

*Welding Engineer, U. S. Welding Co.

†Rules in question were published in The Welding Engineer for February, 1920.

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For aligning broken sections, whether large or small, the usual shimming process may be forgotten and much time saved by using this compound as a cushion for the work. It can be used in hundreds of different ways, over and over again—it don't wear out. The wide awake welder will appreciate its true worth.

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Rep rods used with Rep Flux for filling scores and mending water jackets.

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would recommend that rule No. 5 should be more rigidly enforced and that also a reliable method be invented to prevent a locomotive boiler from getting low water. This happens quite frequently during night shifts, when hustlers oversleep on duty, and to overcome their error, and also to save their jobs, fill the hot boiler with cold water. It is here we really need a remedy. Get conscientious men to do this class of work and devise a method where one can tell when a hustler will burn up a boiler. Furthermore, do not permit any Tom, Dick or Harry to weld a boiler. Just because he has a union card does not mean to say that he is entitled or proficient to weld boilers. Devise a method to examine and license such men before they attempt to weld boilers.

Furthermore, let one visit any railroad shop in the United States, and he will find the men entrusted with the upkeep of locomotives, day or night, to be the most ordinary type of foreign labormen. This was a grave error from the beginning. To watch a locomotive, to have always sufficient water in the boiler, is about the same responsibility as the driver of a locomotive. Intelligent and responsible men that can write, read or speak English should be selected for this class of work. Many an accident happened in blowing up not only a crown sheet but a whole boiler, killing the engineer, foremen or passengers, long before welding was performed on fire boxes. This was due, at that time, to the negligence and lack of conscience of some uneducated foreigner, who was entrusted with the job of feeding water and coal on locomotive fire boxes but who overslept in the cab on the very boiler which exploded a day or two after the damage was done.

In 1909 at the Pennsylvania Railroad Pittsburgh shops one of these night hustlers overslept in the cab of a passenger locomotive. When he woke up, he found that the water was below the third lower gauge. Instead of drawing the fire out at once, releasing the steam pressure and reporting the case to the round house foreman (which would most likely have cost him his job), he tried to cover up his carelessness by immediately filling the hot boiler with cold water. That boiler, on its third trip, just about when it reached Thirty-third street at Pittsburgh, Pa., or twenty-two blocks from the Pennsylvania Station, blew up and the whole boiler separated itself from the frame and flew high up in the air and then dropped about a half mile away into an embankment. It killed the engineer and fireman, and the man responsible lost his job. Fortunately at that time, we did not weld that fire box or else the blame would have fallen on the welding and it may yet have saved the hustler's job.

Such accidents happened about as frequently in the days when crown sheets were not welded, and we have now about the same amount of accidents with welded crown sheets. The difference is, that now they blame it on the welding of crown sheets. Later on, they will blame the welding of side sheets, door sheets and flue sheets. The most peculiar thing is that our boilermakers (who are doing the boiler welding) are welcoming such restrictions because they can still see in the welding process a menace to rob them of their jobs. That is also responsible for the whole federation of labor bluntly bringing pressure upon the former director general to rule that welding in itself is not a trade, but a helping instrument for the union men only. This ruling of course drove away the old veteran welders with the result that new men were put on the job experimenting in welding our locomotive boilers and cylinders with such results that our Committee on Standards has to make new restrictions now when we should be near perfection.

In the commercial field we did not fare any better. One can read in the pamphlets issued by apparatus manufacturers that in paying the price of a welding outfit, one can weld boilers, tanks, refrigerators, fly wheels, etc. The garage men, country blacksmiths, machinists or even the farmers, in purchasing the welding outfit are attempting with a light heart to weld boilers, tanks, etc., because that salesman advised him to do so, that instruction book says so, and when somehow they can close the crack temporarily with burnt metal, they are becoming bolder until they fail once, twice or a score of times. It is the writer's conviction that such salesmen, manufacturers or school teachers, that are promising or encouraging people that everyone that has the price for a welding outfit can weld boilers, are just as responsible for their failures as the careless hustler who allows his boiler to get low water. In fact, the author would recommend to print on the oxygen gauges right below where it is marked "Use No Oil," "Weld No Boilers Unless You Are Proficient." Then the novice welder will stop and think a little that welding of boilers is serious and requires a great deal of practice.

Recently the lawmakers of a couple of states have voted to prohibit boiler or pressure welding of any kind. The insurance companies are withdrawing their policies where a boiler is welded. State boiler inspectors have no love for welding and they are using now the unwritten law so as to prohibit welding in boilers.

All we need now is that Congress should pass a law prohibiting the welding of oxy-acetylene and then we will be able to compare the welding trade and its industry with the history of the saloons and its present prohibition. The only difference would be, that the organized craftsmen would look with more favor upon the prohibition of welding than they did upon prohibition of liquor. However, if the former owners and representative of saloons would have not been so greedy and would have in the past regulated the selling of intoxicating liquors to suit the society of people, they would not have killed their trade and industry. This should serve as a warning now to the railroad shop foremen as well as to commercial shops not to indulge in boiler welding with new inexperienced men. To the salesmen and to the manufacturers of apparatus and supplies, I recommend: "Do not be greedy and most of all do not misrepresent. Regulate your trade and business in such a manner so as not to become a menace to the society of people. In doing this, you and I will be able to put up stronger foundations for the building of the welding trade and its industry." For the beginner or student, I would like to say this: There is a small percentage of humans who have the instinct of performing daring deeds. We need them for our leaders and they are the developers of progress and civilization. They are the ones who are losing their lives in races, in the developing of areoplanes, in finding for us new rivers, seas, or planets. If someone should invent a crude method of traveling to the Mars planet, you will find an immediate army of 100,000 men ready to go even if they would know that about only 100 of them will return. My recommendation to the thousands of welders is, to let such men lead the way, let them develop the higher art of welding pressure vessels until such a time when all would be able to perform and control this art with the best results.

There are in this country quite a few men that have made a success in boiler welding. They can pass any rigid examination, technical or practical, and prove to the Committee on Standards or to the A. S. M. E. Boiler Code Committee that boiler welding is safe and practical.

Instead of depriving the American public of the great saving derived from boiler welding, the author would recommend that in order to settle this dispute, this handful of welders for the present be examined and tested by the former two committees and if the applicants can pass the examination, same committee should give him a license the same as it is given to engineers of boilers, etc. Such action would leave the door open for further developments and progress in this line and yet protect the public from loss of life or property. On the other hand, if arbitrary action should be taken by making every so often, rules and restrictions, pro-

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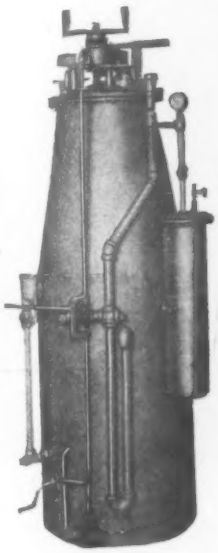

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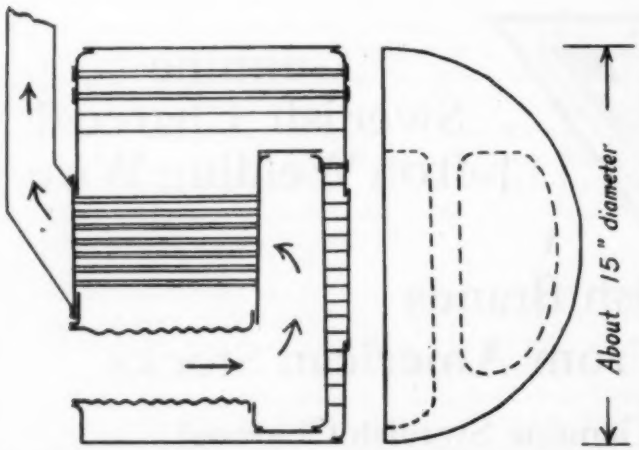
hibiting all welders from this or that so as to cover defects of which the welding was not responsible, or even to represent defects of inexperienced men, such ruling would kill the trade and stop its advance. Then if this is our policy, why not stop the men from flying in aeroplanes? The welding of boilers is, in fact, more advanced and established than the flying in air machines. Furthermore, the former produces only a fraction of accidents as compared with the latter device. Many flying machines are dropping on buildings destroying life and property, some are dropping on groups of people, many aviators are getting killed daily, yet no one dares to stop the progress of developing the art of flying. To be able to fly 200 miles in two hours would certainly reclaim lots of valuable time for valuable men. The same applies to welding. To be able to weld a boiler and save two or three weeks from same boiler to lay idle, will save valuable time for a valuable institution. The art of welding boilers works parallel with any other invention that required in the past patience and endurance. Let the welding trade have its course, regulate same with impartial sound judgment, allowing for the fraction of imperfection which must be applied to all human undertakings, and in time we will be able to control the welding of pressure vessels by a proficient army of welders in such a way that it will not leave any room for criticism by all concerned.

DIFFICULT BOILER REPAIR JOB

Welding a large patch in a flat surface that is rigidly supported is a difficult operation at any time, but is especially difficult in severely cold weather. It may seem strange that a change in temperature so small compared to the temperature of the welding arc would have any effect on the difficulty of making a weld. Nevertheless, it does have a considerable effect.

A job of this kind which was particularly difficult was performed on the boilers of S. S. "Winnebago," by the Electric Welding Company of America, who did the work. Three Scotch boilers, each having three combustion chambers, had burned out



the sheets in the back connections of eight of the combustion chambers which required the insertion of patches, each one of which was approximately 2 feet 6 inches wide by 3 feet high.

Figure 1 shows the general design of the boiler and the location of the patches. Figure 2 shows the firing isle with the air hose for the chipping hammers, and the cable for the welding tools coming down from the hatch-way.

The power for welding and the air for chipping was furnished by a floating plant brought up alongside of the ship. A limited amount of preheating and subsequent heating was used to overcome the effect of the severe cold.

Figure 3 is a close-up of one of the patches and shows the large amount of welding involved in a single patch. This welding, as is plainly shown, is of the multiple string type.

Fig. 2.

The process employed was to weld the top first, the bottom second and the vertical sides last. Figure 3 also shows some welding of a more ordinary character along the calking edges and around one of the rivets.

Fig. 3.

Alloy Welding Processes, Ltd., 14 Cockspur Street, London, S. W., England, are distributing Bulletin No. 32, containing the results of the tests carried out for Lloyd's Register of Shipping who have approved of the use of Alloy Welding Processes, Ltd., electrodes for ship construction.

The Sure Pressure Acetylene Generator Co., 1015 West Main Street, Oklahoma City, Okla., have issued a new circular.

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This is the only complete book on the "Why" and "How" of Welding

Explains in a simple manner apparatus to be used, its care, and how to construct necessary shop equipment. Proceeds then to the actual welding of all automobile parts, in a manner understandable by everyone.

Gives principles never to be forgotten. Aluminum, cast iron, steel, copper, brass, bronze and malleable iron are fully treated, as well as a clear explanation of the proper manner to burn the carbon out of the combustion head.

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Corresponding Secretary

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NEWPORT NEWS, VA.

WHAT SHALL I CHARGE?

Editor:

I have repeatedly noticed discussions in your paper re welding cost and how to make up charges. Would advise, that our system has been for the last twelve years—Cost plus Overhead and Profit. We have a complete record of all Shop Costs, for each and every individual job for the past twelve years, and it is on this basis, and this basis only, that a successful welding organization can survive, the old idea of looking at a job after the work is completed, and asking "How much the job will stand" and "soaking" the customer accordingly, will not get by, today. We have, on several occasions, trebled the cost of a new casting, particularly the cheap ones. We insist that our charges are paid, and are quite willing to do the same work on a casting ten times the value of the invoice. At times, under certain conditions, a certain amount of discretion is shown, but this rule of ours, practically governs 99 per cent of the work that passes through our hands.

I have pleasure in enclosing herewith copies of our Job-Sheet forms for welding, and would be glad to have you publish these sheets if possible and raise a discussion on this basis. During 1919, our turn-over from the Welding Shop was over half a million of business—would advise, that about fourteen years ago, when this business was first organized, that our Paid Up Capital was $8,080.00, paid into the treasurer of the company. Today, our plant is valued at over $80,000.00.

We have extremely good credit ratings in Bradstreets and Dun's, and are working a very large business, all of which was built up and paid for on the Cost plus Over-head and Profit charges; this will tend to prove that our methods must be nearly right. Other shops that have been starting under similar conditions, but working their charges on the old method of "How much the job is worth" are continually coming and going; none of them survive.

We will be glad to see a discussion in your paper along these lines.

A. M. Barry, Vice President and General Manager,
The St. Lawrence Welding Co., Montreal.

AIRPLANE DELIVERY TO MIAMI WELDING GARAGE

Editor:

I am enclosing newspaper clipping taken from the Miami Herald of February 29th, 1920. The parts welded were two castings weighing 110 pounds. I welded them with one arm, having lost my right arm, which was blown off by accident on August 27th, 1918, and wish to say that I am making a good living in the welding business, and have all that I can attend to.

"It is believed the ultimate in service has been reached with the arrival last week of some parts from Nassau for the welding shop of Carl Nobis, Weathers Service Garage No. 2, by airplane. The work which was to be done on an essential part of a Nassau newspaper printing press was finished in record time by Carl and returned by airplane to the islands."

Carl Nobis.

The Wilkes-Barre Welding Company, Wilkes-Barre, Pa., have secured patents on the Johnson patented engine support bracket for Ford automobiles. It is quickly attached to a new, old or broken arm and prevents breaks because of the added strength. It also prevents vibration.

Katsutaro Kawano, 268 Ihioka, Nishi-Ku, Osaka, Japan, desires catalogues, literature, etc., covering welding apparatus and supplies.

CUTTING UNDER WATER WITH AN OXY-ACETYLENIC BLOW PIPE*

The process of under-water cutting was already known before the war and very interesting results had been obtained in France and Germany. In the port of Hamburg, particularly, the experiments and results obtained were surrounded with mystery.

In France, this problem may be considered as solved, for the last few years, and the practical realization of this process has been undertaken by the "Soudure Autogène Française" (French Welding Society) which has perfected an oxy-acetylenic blow-pipe entirely special, called under-water cutting blow-pipe. Trials of this blow-pipe, started before the war, have given very encouraging results, but were abandoned during the hostilities.

Two years later the question was taken up again but under a different order of ideas: by using the electric arc.

It is a known fact that it is impossible to prime an electric arc under water and during the trials insulated metallic electrodes were used, then those made of carbon and finally, without success, however, hollow electrodes allowing insufflation of an oxygen jet.

For several reasons, the experiments relative to cutting by means of an electric arc were interrupted and the Society "La Soudure Autogène Française" resumed the perfecting of the oxy-acetylenic blow-pipe, which after having gone through several transformations and modifications of details, was presented to the National Navy in 1917.

The principle of its operation is based on the possibilites of an oxy-acetylenic flame to be insulated from the bulk of the water in which it happens to be, if it burns in a space fed by the air driving back the water. This result is obtained by covering the nozzle of the cutting blow-pipe with a bell of proper shape and size which receives compressed air through a canalization.

The shape of the blow-pipe is that of a "Oxy-Secator" comprising the bell to which is connected a tube with fittings carrying the air which is distributed to the bell through two separated connections. This air is regularly distributed through specially studied channels which come out into the bell through an annular aperture surrounding the heating nozzle. The air bell is provided with three round shaped guides keeping it away from the matter to be cut; these guides also maintain the flame to an invariable distance from the said matter.

The starting, regulating and operation of this blow-pipe are the same as any cutting blow-pipe; besides the necessary gas, a supply of compressed air regulated to a proportionate pressure to that of the liquid center in which it is operated, must be kept, that is to say, varying with the depth in which the work is done. The oxygene and acetylene pressures, this last gas being always used under dissolved acetylene form, perform themselves the function of water pressure to the depth under consideration.

Before going under water, the diver who is to perform the cutting operation lights and regulates his blow-pipe outside, then he orders the compressed air to be turned on, regulated beforehand to the necessary pressure, and may then dive with the apparatus all lit up.

The green lights of the oxy-acetylenic flames visible among the tumultuous boiling of the water, when the blow-pipe is not deeply submerged, allow one to follow the operation.

The work of the operators is very difficult on account of the strength required to apply the blow-pipe against the part to be cut, of the visual attention necessary for the exe-

---

*From Revue De La Soudure Autogène.

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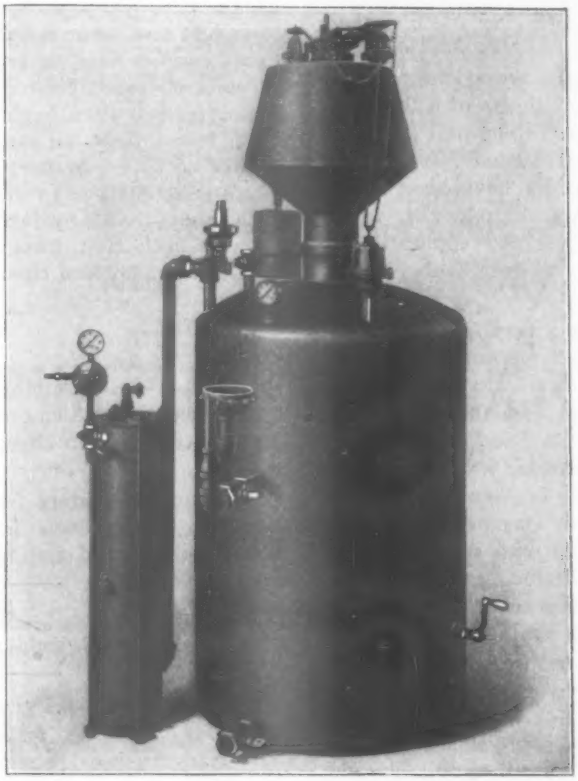

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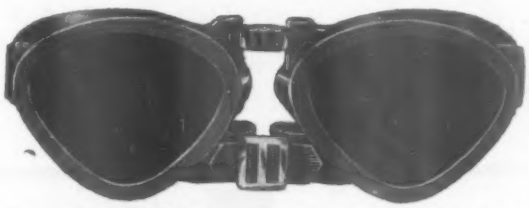

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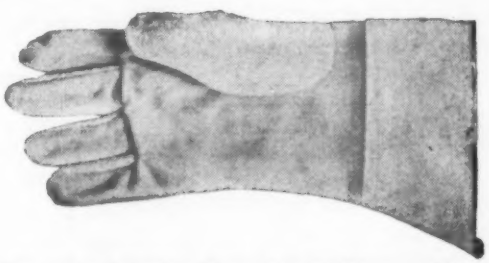

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cution of the cutting, of the difficulty of striking at the same spot when needed and especially of the deafening noise caused by the pressure of the escaping gas amplified by the resonance of the metallic helmet.

What is more, the diver's movements are often hindered by the current and he must be perfectly familiar with his diving apparatus so that he may save a great part of his attention for the operating of his apparatus.

Except for these difficulties, cutting under water is done as in the regular manner, that is to say, by previously bringing to red heat, by means of the heating flame of the blow-pipe, a part of the metal sheet or of the piece to be cut, by throwing on the oxygene jet and then by bringing the blow-pipe gradually closer.

The results obtained during the trials were most encouraging. Thus, at a depth of 5m 20 iron sheets of a thickness of from 8 to 22 mm were cut. A cut of 400 mm long was made in six minutes in a metal sheet of 20mm.

Since then, a certain amount of posts have been established in the French, English and American Navies, which have created a special personnel for this new application of the cutting-blow-pipe to the works of demolishing under water, the sea or a river.

Before ending, we wish to mention a very interesting accessory for the cutting blow-pipe which permits its lighting it while submerged. This apparatus is due to an ingenious inventor, Mr. Corne, and is composed of a movable fitting equipped with springs, attached to the bell and which is connected to a brass tube containing a powder which is inflammable by contact with water. The tube is closed by a rubber stopper equipped with a ring so that it may be taken off at the desired time. The fitting equipped with springs allows the lighting tube to present its aperture facing the nozzle of the blow-pipe at the time of the lighting and is pushed back after so as not to prevent the cutting operation.

Thus the loss of time resulting from the diver being obliged to come back to the open air with the blow-pipe to light it, is prevented by the use of this ingenious system. The operator equips himself with these "matches" at the time of the diving and can thus start his blow-pipe should any accidental cause provoke its extinction.

The technical part of the process which is here described is evidently only in the experimental stage and will undergo as well as the apparatus, some improvements and transformations. Even though it has a limited field of applications, the cutting blow-pipe for under water purposes has already shown its usefulness and will render better services in the future for salvage work, clearing away, etc.

Marcel Piette.

I. A. OBSERVES ROUNDHOUSE OPERATION.

Washington, D. C.

Dear Editor:

While Imperial Government are operate RR, I. C. C. detectors no longer can issue Form 5 invitation on hon. MM, so U. S. R. A. employ Jap detector as Shop detector. It our august duty to learn why former proud haughty RR and MM find impossible to keep running U. S. R. A. std. locomotive and car.

In pursuit of duty, Hon. Boss Detector send for me pos haste. I execute double quick to headquarters and learn Hon. Boss much exercised for Green River Jct.

RR building new roundhouse there, which are not perform right. Jap detector empowered to find what are wrong without delay.

Arrive Green River Jct. Find engines standing emitting steam to atmosphere, which are very cold and result in condensed steam return to earth like snow. Detect further find loco. house situate on bank of river which looks fine, but it are situate so close to bank, that outside wall turn table pit are in river. This account for phenomena observed when RH are approached. Juice have fail on motor, which make it nice to push 90-feet table by hand when river are on one side.

Roundhouse look out west, so when doors open let engine out, let wind in, which result in economy; as do without sweeper.

Find machines all motor push, which are good. However, main transmitter are blow out on occasion visit; no table, no machines, no pump, no water for boiler—whole damn works go to hell fast. But RR demand engines. RH foreman tells them, "engines here, he are impotent, come get 'em."

Detect no sand; reason it are froze. RR order when hot climate, get it when begin to be cold. No men to unload, stand, freeze tight, no sand. Picks, dynamite, sand stick by car like rock of gibralter. Build fire in car, thaw some, but only one sand-stove to dry sand. RH foreman, swear, say, "take sand to stick by job."

Report back Hon. Boss, Green River Jct. all right, if build right. Advise he send chief shop line-drawer to operate.

Ino Amsura.
Ry. Mechanical Engineer.

The Moore Shipbuilding Co., San Francisco, employes eighteen welders, 115 cutters and twenty-four electric welders. The department is in charge of Edward Dustin.

The Messer Welding Supply Corp., 113 Eleventh Street, Brooklyn, N. Y., have issued Bulletin No. 51 describing Messer welding and cutting torches.

The first issue of La Saldatura Autogena, the monthly organ of the Italian welding interests, is off the press.

The Welding Works, Inc., 1805 Lovegrove Street, Baltimore, Md. have issued an attractive and well-illustrated little booklet advertising job welding.

The Alexander Milburn Co., Baltimore, Md., have issued a circular describing Milburn industrial electric flood lights.

The Superior Welding & Brazing Co., has recently been launched at 82 Main Street, Oil City, Pa. Mr. A. B. Petrikin and Mr. James W. Haygood are the owners. Mr. Haygood had charge of the A. E. F. welding shop in France and both gentlemen recently left the Air Reduction Sales Co. to start this new business.

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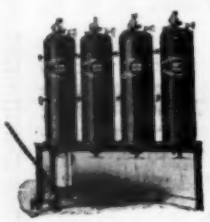

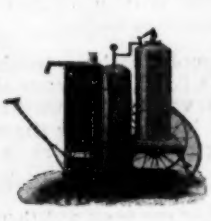

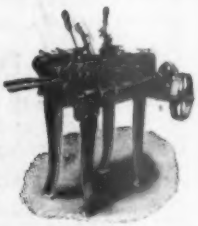

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